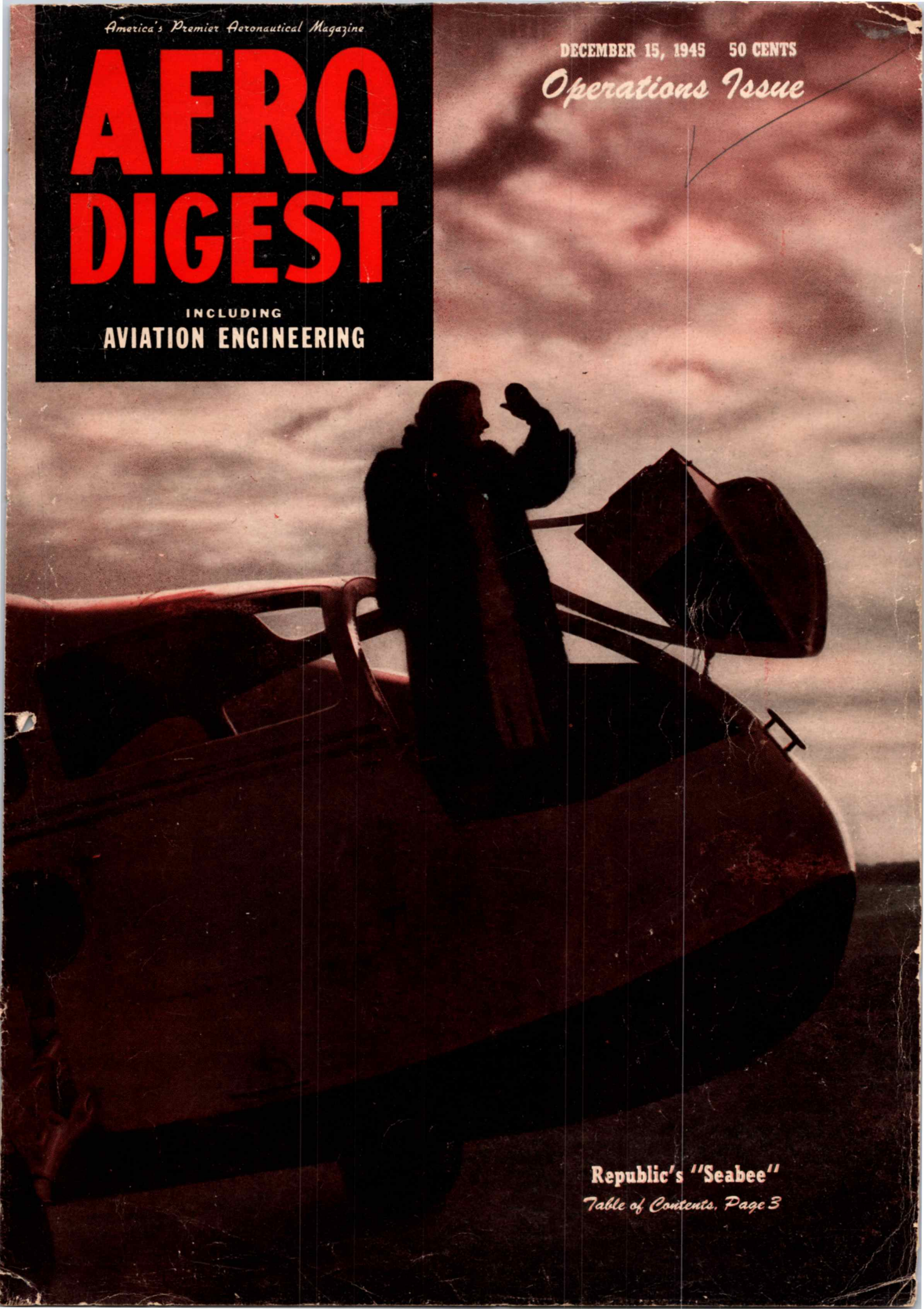
America's Premier Aeronautical Magazine

AERO DIGEST

INCLUDING
AVIATION ENGINEERING

DECEMBER 15, 1945 50 CENTS

Operations Issue



Republic's "Seabee"

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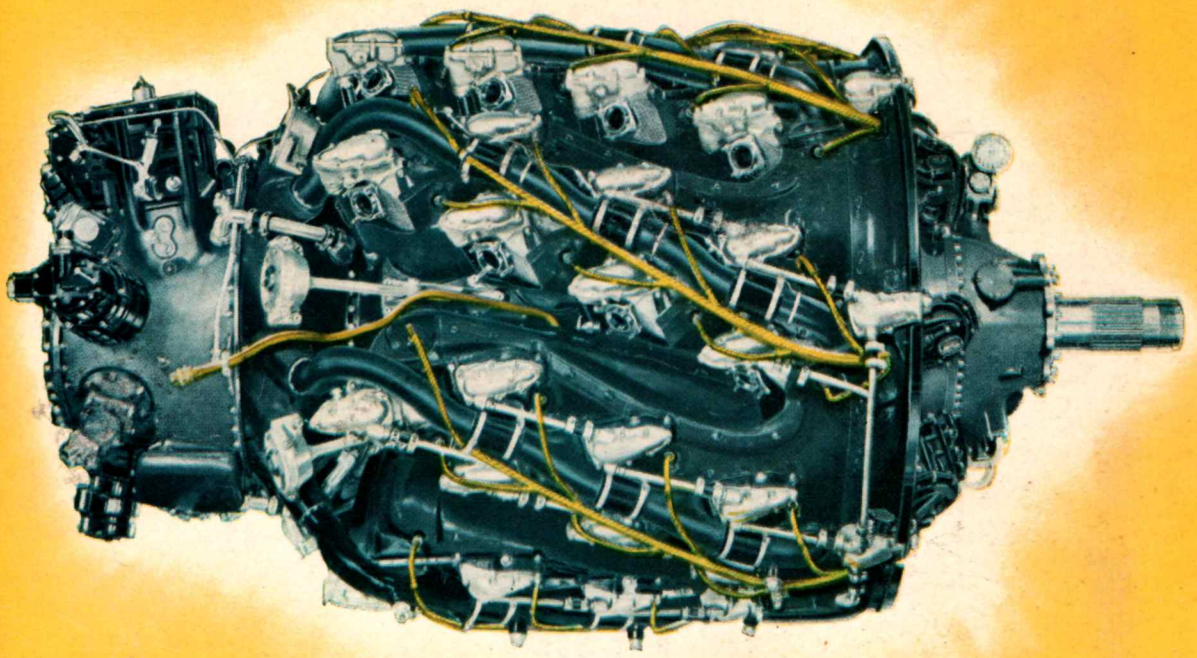
3500 horsepower—*plus*



Pratt & Whitney Aircraft again leads the way to higher horsepower. The new Wasp Major is the most powerful aircraft engine in production in the world — delivering 3500 horsepower — plus. Already it has been selected to power such air-giants as the Boeing Stratocruiser, Douglas Globemaster, Hughes Hercules, Martin Mars, Republic Rainbow and Consolidated B-36 as well as the F2G Goodyear Corsair and eight Army and Navy aircraft not yet publicly announced.

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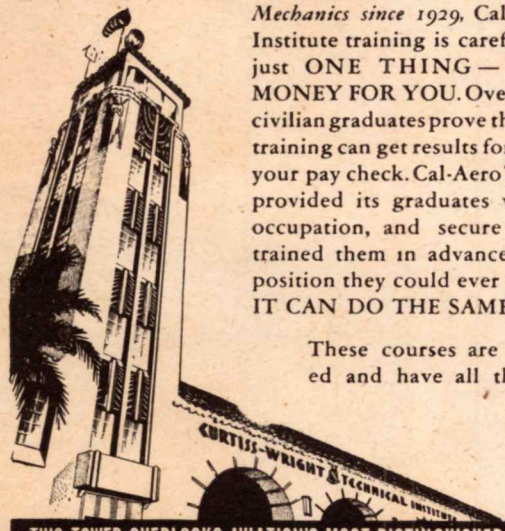

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. . . For Progress in Radio

Here are views of the just-completed Collins hangar at the Cedar Rapids Airport, and the company's 18S twin-engined Beechcraft. The installation is dedicated to constant advancement in the design and performance of radio communication and navigation equipment for aviation.

The wing to the right of the hangar contains laboratories for Collins physicists, engineers, technicians and mechanics engaged in specific projects that require much space and the use of the plane.

Customers of Collins equipment are invited to remember that these facilities are available for installation and service. The Cedar Rapids Municipal Airport, with its 5400 ft. runways, will accommodate the largest aircraft. Collins Radio Company, Cedar Rapids, Iowa; 11 West 42nd Street, New York 18, N. Y. In Canada Collins equipment is sold by Collins-Fisher Limited, Montreal.

IN RADIO COMMUNICATIONS, IT'S . . .

COLLINS

VOLUME 51 NUMBER 6

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DECEMBER 15, 1945

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5,000 WERE ASKED . . . As a guide to the private plane manufacturer in developing his new models, more than 5,000 pilot and pilot-owner members were recently asked by the Aircraft Owners and Pilots Association to state, on the basis of their experience, their instrument requirements in the new planes which they planned to purchase. ¶ The replies of this experienced group, three-fourths of whom are or have been plane owners, will be of interest to all who, themselves, plan to purchase planes. ¶ The results showed that these pilots were overwhelmingly in favor of "better" instruments than most private planes contained. And they were willing to "pay more" to get them. Reasons: "To make flying safer . . . to increase the utility of my ship . . . for efficiency and economy." Over 80%, for instance, want Sensitive Altimeters in their new planes. ¶ To meet the need so clearly outlined by these thousands of pilots, Kollsman has developed a new line of instruments designed and *priced* for the private plane owner. Full details of these instruments will shortly be announced. ¶ Meantime, Kollsman is making available the pilots' answers to the sixteen basic questions in the AOPA Survey. For your copy, write Advertising Dept., Kollsman Instrument Division, Square D Company, 80-08 45th Avenue, Elmhurst, N. Y.

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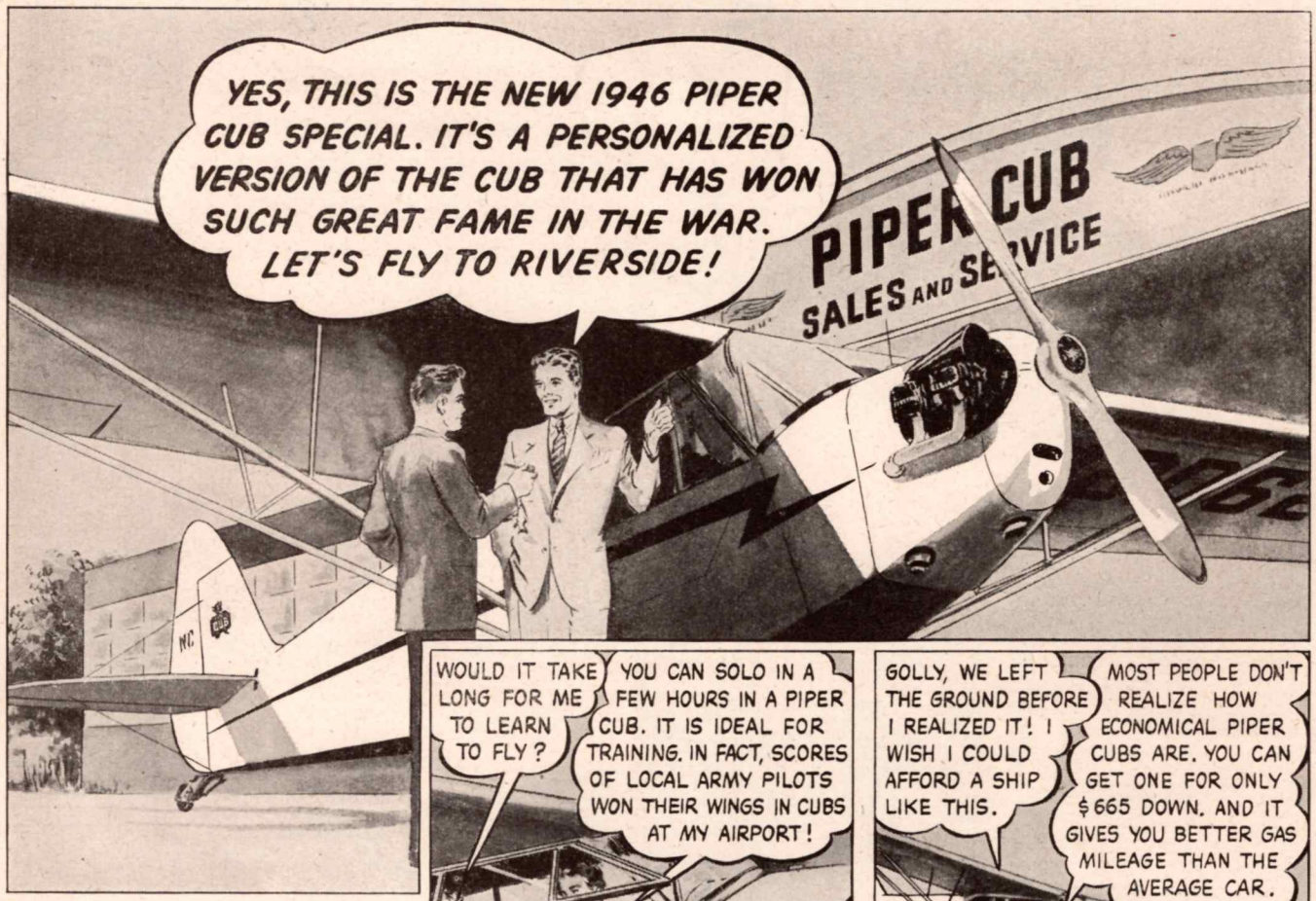
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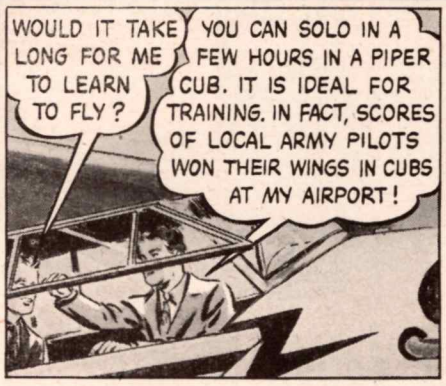
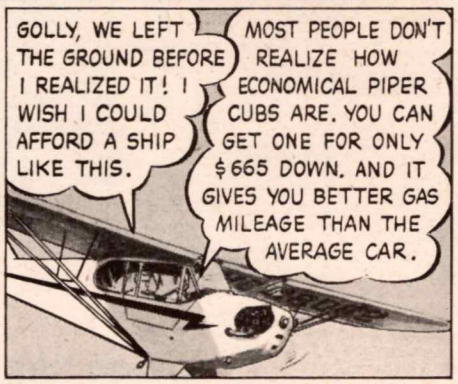
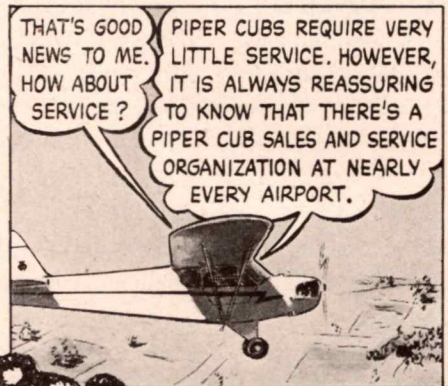

WOULD IT TAKE LONG FOR ME TO LEARN TO FLY?
YOU CAN SOLO IN A FEW HOURS IN A PIPER CUB. IT IS IDEAL FOR TRAINING. IN FACT, SCORES OF LOCAL ARMY PILOTS WON THEIR WINGS IN CUBS AT MY AIRPORT!


GOLLY, WE LEFT THE GROUND BEFORE I REALIZED IT! I WISH I COULD AFFORD A SHIP LIKE THIS.
MOST PEOPLE DON'T REALIZE HOW ECONOMICAL PIPER CUBS ARE. YOU CAN GET ONE FOR ONLY $665 DOWN. AND IT GIVES YOU BETTER GAS MILEAGE THAN THE AVERAGE CAR.


THAT'S GOOD NEWS TO ME. HOW ABOUT SERVICE?
PIPER CUBS REQUIRE VERY LITTLE SERVICE. HOWEVER, IT IS ALWAYS REASSURING TO KNOW THAT THERE'S A PIPER CUB SALES AND SERVICE ORGANIZATION AT NEARLY EVERY AIRPORT.

I CERTAINLY LEARNED A LOT FROM THAT RIDE. I GUESS A PLANE ISN'T A RICH MAN'S PLAYTHING AFTER ALL!
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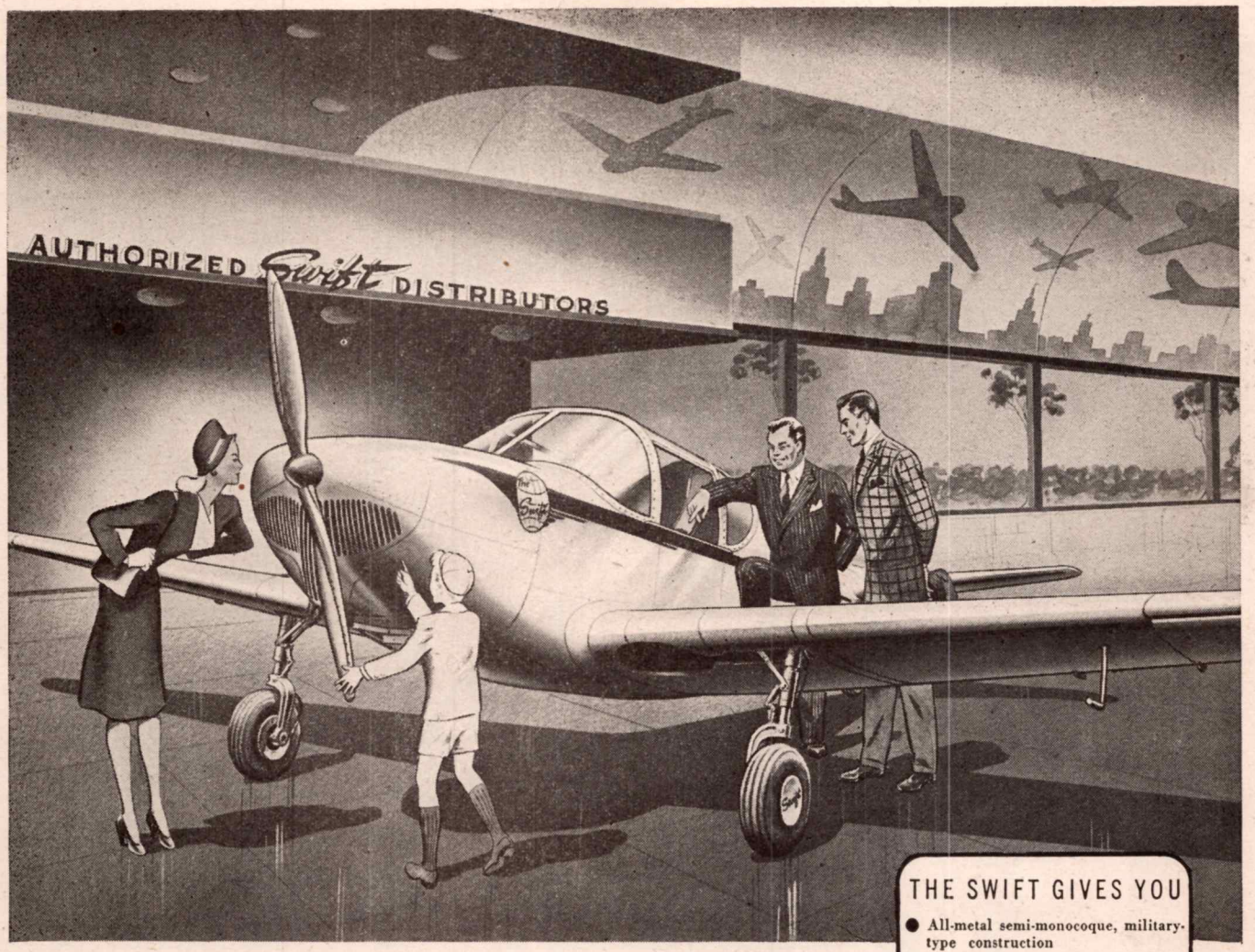

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Here's a quick-paying, money-making investment... an All Metal *Swift* for your BUSINESS travel

Get a flying start to business leadership, step into top earnings quicker, by making your business calls the *modern* way . . . in a swanky new *Swift*. Forward-thinking business men who are flying profitably today enthusiastically tell of business days saved, new sales records set, profit-making contracts closed, traveling expenses slashed, and more time at home with the family.

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And the new *Swift* gives you *everything* it takes to make your ***business*** flying profitable. It's *all-metal* . . . sturdy, weather-proof, easy to maintain. It has plenty of power and rugged stability for flying in any weather thats safe for *any* airplane. It's simple and easy to control . . . restful to fly, and there is plenty of speed, power, and range for safe, easy cross-country travel.

Write for the records of business men who have flown their way to leadership, men with years of profitable business flying behind them. Read these records, and you will realize that owning and flying a new *Swift* can be one of *your* most valuable business assets.

Be one of the fortunate 4,000 who will own a new *Swift* in 1946. Place your order with your *Swift* Dealer NOW.

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The Swift

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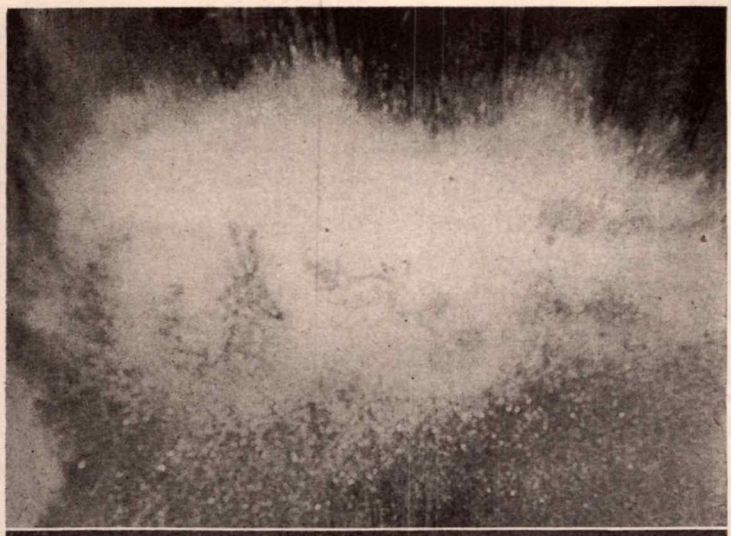
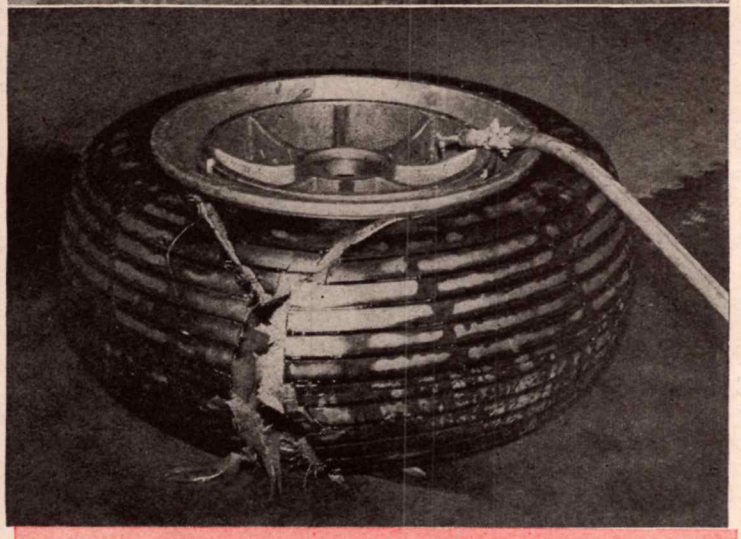
Torture chamber for tires means

HOW MANY LANDINGS?

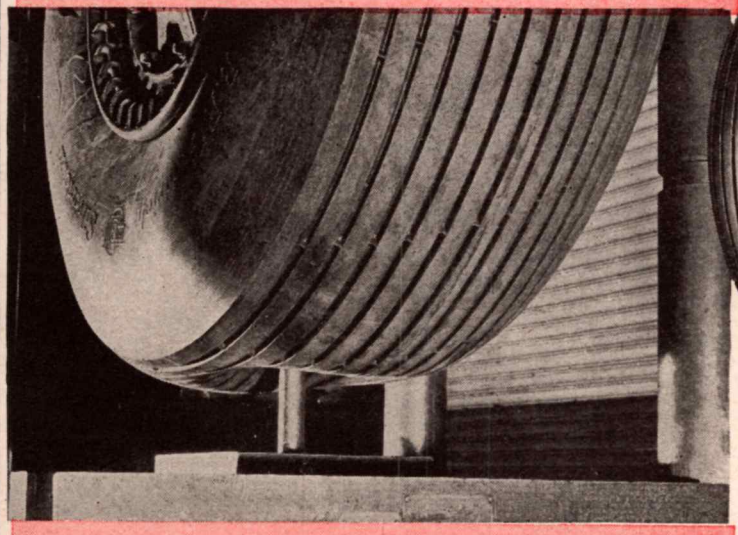
B. F. Goodrich counts the landings on this "indoor landing field" where Airplane Silvertowns are run to destruction to be sure that they are more than just "up to standard."

safer landings for planes . . .





BURST TEST! Water is forced into a B. F. Goodrich tire. The pressure mounts... up to many times that encountered in service. Finally (top picture), the tire bursts . . . is completely ruined as the second picture shows. Gauges record the story of a wide factor of safety.



WHAT ABOUT BRUISE RESISTANCE? Here's the test that finds out. The tire is forced down onto a steel rod under steadily increasing pressure. Down, down until something has to give. And the post-mortem leads to still further developments for greater tire safety.

B. F. Goodrich Silvertowns prove they can take it before they take off

LANDINGS are big moments in airplane tires' lives . . . moments when they have to take the shock of many tons multiplied by plenty m.p.h. If they're B. F. Goodrich Silvertowns, they're ready to take it . . . with lots to spare. Shown here are some of the reasons why.

B. F. Goodrich technicians "land" tires inside a building. They're smacked down with great force against a high-speed dynamometer and braked until the multi-ton flywheel comes to a stop. This "landing" is repeated time and again with careful wear and performance checks all the way.

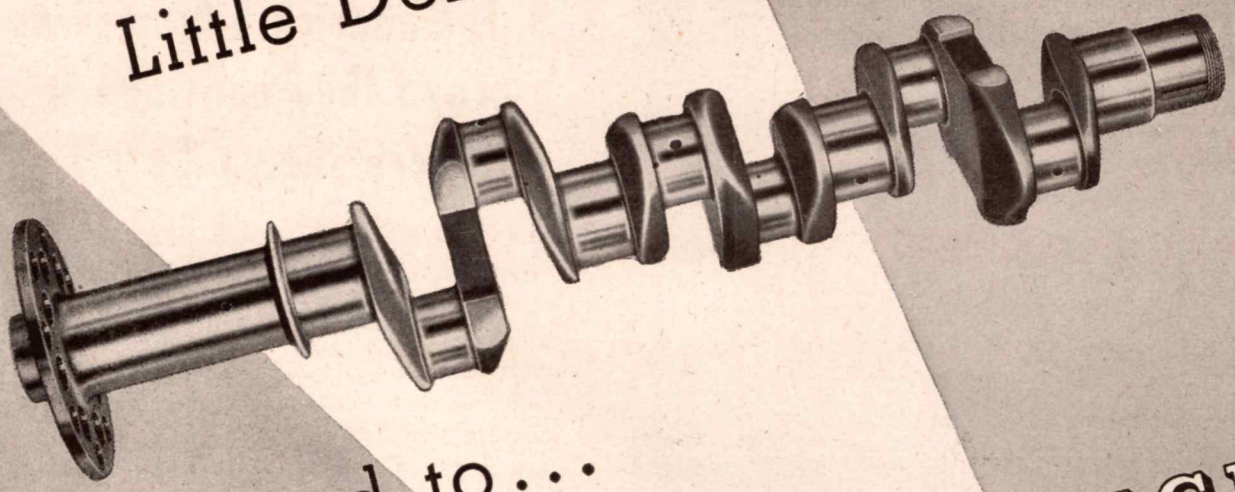
Then there are tests for bruise resistance, heat resistance, fatigue resistance, and others —altogether a "torture chamber" for tires. These are some of the ways B. F. Goodrich makes sure Airplane Silvertowns are kept up to *tomorrow's* standards—always ready for the new and heavier demands of larger and faster planes. *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

Skyway or Highway

B.F.Goodrich

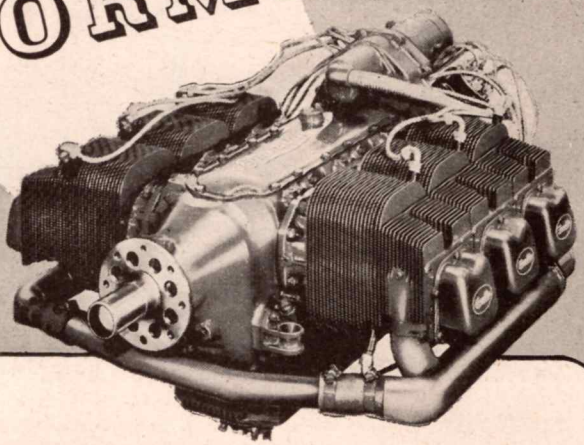
FIRST IN RUBBER

Little Details



Lead to . . .

BIG PERFORMANCE



Heavy-Duty Crankshaft
Materially Reduces Maintenance Costs

One detail contributing to the fine performance of the post-war Franklin engines is the new heavy-duty crankshaft. Husky enough to take any load that will ever be imposed on it, the alloy steel shaft is NITRIDED to give unlimited service life and freedom from scoring or wear of the large bearing surfaces.

This is typical of the many details of engineering development that make *"powered by Franklin"* your sure guide to safe, low-cost flying when you purchase your personal plane.

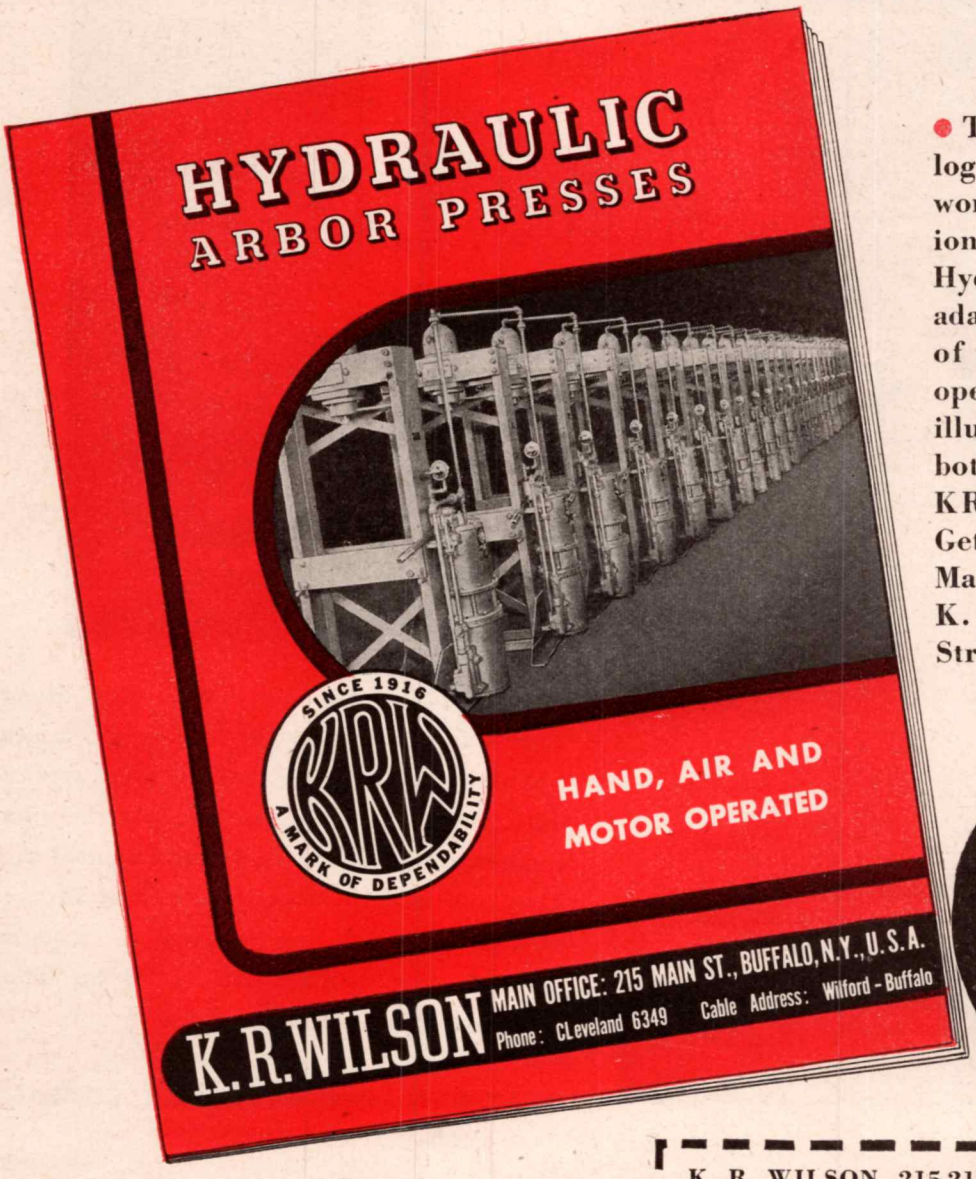
The confidence you feel when you fly behind a Franklin is what makes flying fun.

AIRCOOLED MOTORS CORPORATION
SYRACUSE 8, N. Y.

Franklin
FINE AIRCRAFT ENGINES

NEW KRW HYDRAULIC PRESS BOOK

of Profitable Production Ideas



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10

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HIGH FREQUENCY ELECTRIC

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Phillips Aviation Gasoline goes aboard while crew unloads 21-passenger Douglas Airliner operated by Continental Air Lines.

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Just eleven years old this past summer, Continental showed a 1-year increase of 121% in revenue passenger-miles flown in 1945.

We're interested in this figure because we played a part in helping create it. Over the past 4½ years Continental has flown over 9 million Phillips-powered miles—consumed 4 million gallons of Phillips Aviation Gasoline!

Now that's a pretty good record—for Continental *and* us. But what is more important, we think, is the satisfaction and good-will we've built at Continental.

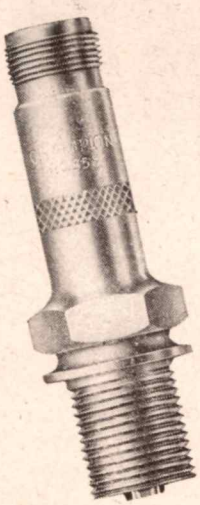
This is an advertisement for our Aviation Gasoline. And we think the best tip-off on *any* product is the kind of folks who use it. Ask *them* about Phillips products and Phillips Service. Or ask us. Just write to the Aviation Department, Phillips Petroleum Company, Bartlesville, Oklahoma.

Robert F. Six, President of Continental Air Lines, is America's youngest airline president.

Phillips
AVIATION GASOLINE

Billion Mile Safety Record . . . Proof of the Dependability of

CHAMPION SPARK PLUGS



RC35S—Shielded

Once again the absolute dependability of Champion Ceramic Aircraft Spark Plugs is dramatically demonstrated in the award of the National Safety Council to United Air Lines for more than a billion passenger miles flown without a single fatality.

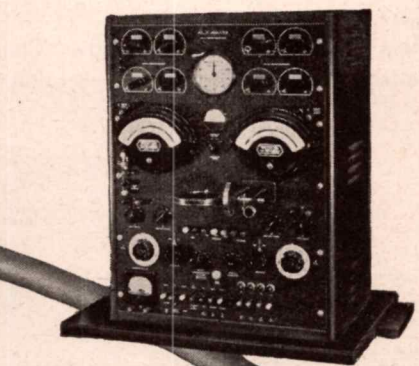
This award is all the more significant because it was established in war years when the number of planes available for service was at a minimum—miles flown at the maximum. Dependable Champion Spark Plugs have been standard equipment on every United Air Lines Mainliner since 1942.

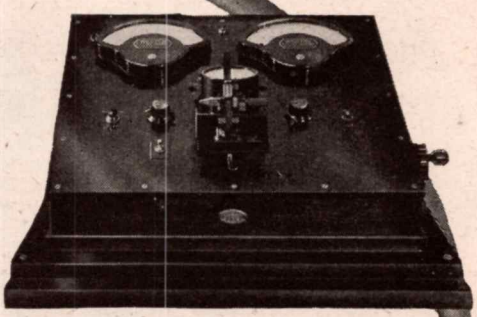
In *every* aircraft engine—commercial, military, for personal planes, yes, and even in types for model engines — Champion Ceramic Aircraft Spark Plugs insure the same unfailing service as that experienced by United and other leading airlines. For *all* Champions, regardless of type, are products of the same unequalled research, engineering and manufacturing facilities. Champion Spark Plug Company, Toledo 1, Ohio.

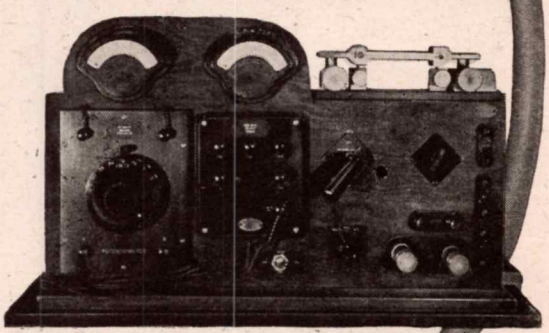
C26—Unshielded

INSTALL CHAMPIONS AND FLY WITH CONFIDENCE

Start RIGHT AND YOU End RIGHT!





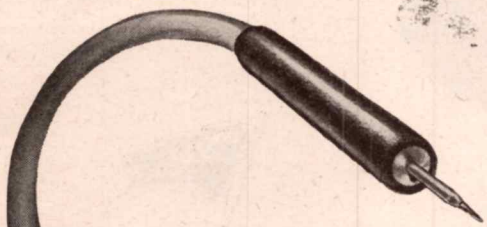


with WESTONS ON ALL PRODUCTION TEST-STANDS AND INSPECTION EQUIPMENT!

With the race for markets in full swing, electrical manufacturers are eliminating costly production bottlenecks by providing *uniform dependability* in testing procedure all along the line. From the inspection of purchased components right through to final product inspection, they insure accurate testing by using instruments they can trust.

And it's easy to insure *measurement dependability* at every step, because there are WESTONS for every testing need . . . including types for all special test-stand requirements, as well as a broad line of multi-range, multi-purpose test instruments. These compact, multi-purpose testers often afford new simplicity and economies in testing procedure, while assuring the dependability for which WESTONS are renowned.

Literature describing the complete line of WESTON panel and test instruments is freely offered . . . Weston Electrical Instrument Corporation, 600 Frelinghuysen Avenue, Newark 5, New Jersey.



Weston Instruments

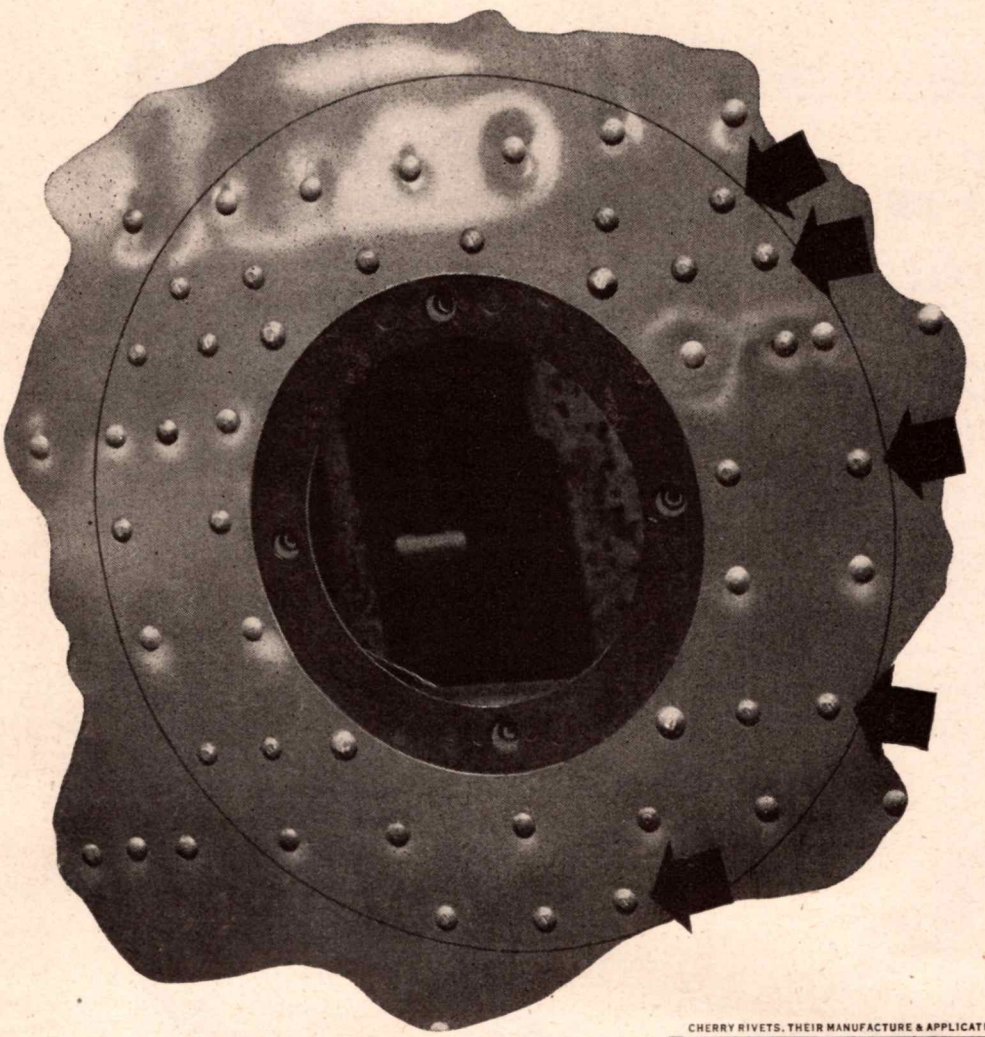
ALBANY • ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • JACKSONVILLE • KNOXVILLE • LOS ANGELES • MERIDEN
MINNEAPOLIS • NEWARK • NEW ORLEANS • NEW YORK • PHILADELPHIA • PHOENIX • PITTSBURGH • ROCHESTER • SAN FRANCISCO • SEATTLE • ST. LOUIS • SYRACUSE
In Canada, Northern Electric Co., Ltd., Powerlite Devices, Ltd.

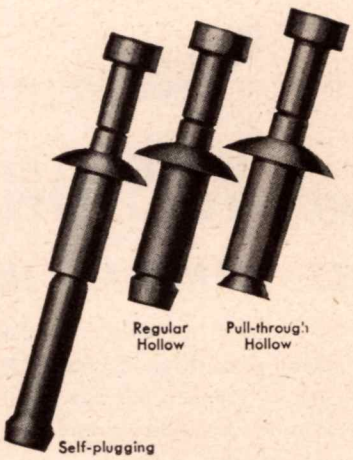
Controlled UPSETTING ACTION OF CHERRY BLIND RIVETS *Minimizes* SURFACE DISTORTION

The photograph below shows hand hole construction in a large wing section. Both ordinary solid rivets and Cherry Blind Rivets have been installed. Note the surface distortion around the solid rivet installations. Then notice that there is no deformation around the Cherry Rivets, indicated by the arrows.

Cherry Rivets do not mar surfaces, because these rivets are upset by a controlled pulling action, rather than the severe pounding force which accompanies ordinary rivet installations.

This pulling action also allows Cherry Riveting from one side of any application, by one operator, without bucking. Cherry Rivets can be used in soft or brittle materials, as well as all sheet metals. Their strength values and vibration resistances are comparable with solid rivets. Material thickness and hole size tolerances are unusually generous. Cherry Rivet guns are small, easy-to-handle pneumatic or manually operated tools.





Note surface deformation, indicated by highlighted areas, around ordinary rivet installations. Cherry Rivets are indicated by arrows. Surface deformation around them is minimized.

ARMY E NAVY

CHERRY RIVETS, THEIR MANUFACTURE & APPLICATION ARE COVERED BY U. S. PATENTS ISSUED & PENDING

For more details get your copy of Manual D-45. Contact your nearest jobber or write directly to the Cherry Rivet Company, Dept. A-103, 231 Winston Street, Los Angeles 13, California.

Cherry Rivet Company
LOS ANGELES 13, CALIFORNIA

The true AD-VENTURES of Charley Jacobs

xlaoall02mpxoPS''...*powerBo rpnompo4:

ph*. Charley Jacobs is Advertising Manager of Klein's Sporting Goods, Chicago. You've heard of Klein's. If a fighting trout sings you a spring song, and you're pals with a golf ball, you've been there. Klein's is the largest men's sportswear mail-order house in America.

Charley Jacobs knew about TRUE . . . had heard what it would do . . . would it do that for Klein's? He'd find out . . .

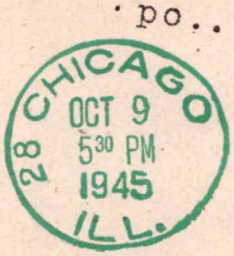
So he did. Klein's ran a 92-line test ad in May.

Charley wrote us an unsolicited letter about the results . . . . . oea

-!''4.aFeorpnompoxoe

'x·po.. Klein's tried it again in the June TRUE.

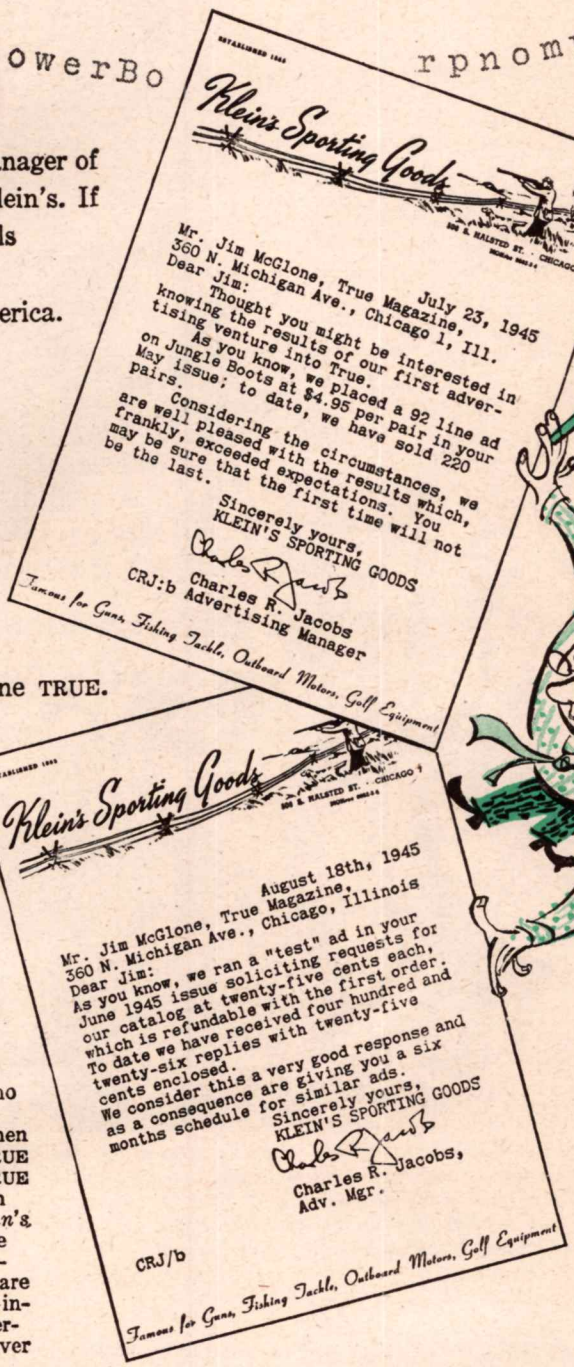
And Charley wrote us another letter . . . . . a



..*powerBoxlaoapxopS''

·po2m· That's the story of Charley Jacobs' TRUE Ad-Ventures so far. Other good things will happen. happen to all of you who use TRUE.

More than 900,000 men will buy the December TRUE at their newsstands. TRUE readers pay a premium price to get *the only man's magazine of its kind.* More than 130 leading advertisers of things men want are using TRUE this year—increasing TRUE'S 1945 advertising revenue 361% over 1944!


Klein's Sporting Goods
Mr. Jim McGlone, True Magazine, July 23, 1945
360 N. Michigan Ave., Chicago 1, Ill.
Dear Jim:
Thought you might be interested in knowing the results of our first advertising venture into True.
As you know, we placed a 92 line ad on Jungle Boots at $4.95 per pair in your May issue; to date, we have sold 220 pairs.
Considering the circumstances, we are well pleased with the results which, frankly, exceeded expectations. You may be sure that the first time will not be the last.
Sincerely yours,
KLEIN'S SPORTING GOODS
Charles R. Jacobs
CRJ:b Advertising Manager
Famous for Guns, Fishing Tackle, Outboard Motors, Golf Equipment
Klein's Sporting Goods
August 18th, 1945
Mr. Jim McGlone, True Magazine,
360 N. Michigan Ave., Chicago, Illinois
Dear Jim:
As you know, we ran a "test" ad in your June 1945 issue soliciting requests for our catalog at twenty-five cents each, which is refundable with the first order. To date we have received four hundred and twenty-six replies with twenty-five cents enclosed.
We consider this a very good response and as a consequence are giving you a six months schedule for similar ads.
Sincerely yours,
KLEIN'S SPORTING GOODS
Charles R. Jacobs,
Adv. Mgr.
CRJ/b
Famous for Guns, Fishing Tackle, Outboard Motors, Golf Equipment

The Man's Magazine true

FAWCETT PUBLICATIONS, INC.
295 Madison Avenue, New York 17, N. Y.

Sells men for you

World's Largest Publishers of Monthly Magazines

IN THE 50's, *our founders were making pipes which were enjoyed all over America*

Today:
the modern *Flame-Grain*
Kaywoodie, a specimen-pipe
handsomely marked by Nature, $10.
Shape No. 12B. "Saddle Bit Bulldog."

COPR. 1945

Steamboats plied the Mississippi, and one of the founders of our business travelled on the River, and by stage coach, on his way to answer the call for pipes from the growing South and West. He took pipes to the newly discovered gold fields of California in 1854. A reproduction of the Steamboat illustration in colors, together with booklet illustrating Kaywoodie Pipes, will be sent on receipt of 10¢ to cover costs. Write to Kaywoodie Company, West New York, New Jersey.

Ninety-four years devoted to producing satisfying pipes have culminated in the Kaywoodie Pipe which you buy today. In it are incorporated the best qualities garnered from those years of experience with pipe-smokers' habits and preferences. From the new Kaywoodie Pipes you will get everything that enhances the pleasure of pipe-smoking. Kaywoodies may be had at your dealer's, $3.50 to $25. Kaywoodie Company, New York and London.

The term "Kaywoodie Briar" means briar that has been IMPORTED, inspected and graded to meet our exacting requirements, and satisfactorily seasoned exclusively for Kaywoodie Pipes.

BUY VICTORY BONDS

NEW TURCO STRIPPER REMOVES PAINT WITH COLD WATER RINSE!

Only Turco Paint-Gon Gives You This

Non-Inflammable, High-Speed Action

Proved on the toughest of war time jobs, this outstanding Turco paint stripper solves the difficult, time consuming, problem of removing paint through the miracle of Surface Chemistry.

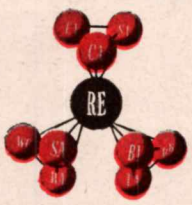
Turco Paint-Gon is applied by brushing, scrubbing or spraying—spreads easily and uniformly, clings well to vertical surfaces. It is swift in action, removes coatings in 5 to 20 minutes, so that they may be flushed away with water. It is free rinsing and leaves no gummy adhesive residue or film. It is non-inflammable (does not require the use of inflammable, volatile solvents).

Turco Paint-Gon is safe and non-corrosive to aluminum, magnesium, steel, cadmium, iron, zinc, or galvanizing.

Turco Paint-Gon is effective on all kinds of coatings *regardless of their condition*—paint enamel, baked enamel, varnish, lacquer, automotive synthetic enamel, etc.

Get the complete story on this amazing development. Phone or write your nearest Turco Field Representative.

THIS IS TURCO *SURFACE CHEMISTRY



© 1944 TURCO PRODUCTS, INC.

Surface Chemistry is the scientific balance and application of these cleaning factors to a specific problem.

WA—Wetting Action
EA—Emulsifying Action
SV—Saponifying Value
SA—Solvent Action
CA—Colloidal Activity
WC—Water Conditioning
BI—Buffer Index
pH—Energy of Alkalinity
TA—Total Alkalinity
RE—Research and Experience, the combining factor that puts all the above elements into balance and to work on your specific problem.

TURCO INDUSTRIAL CLEANING COMPOUNDS

TURCO PRODUCTS, INC. Main Office & Factory: 6135 S. Central Ave., Los Angeles 1
Offices & Factories: 125 W. 46th St., Chicago 9 · 1606 Henderson St., Houston 1, Texas
New York Office: 415 Greenwich St., New York 13 · Offices & Warehouses in All Principal Cities

TURCO PRODUCTS INC.
Dept. AD-12, Box 2649, Los Angeles 54, Calif.
Please send information on the following:

- ☐ Turco Paint-Gon
- ☐ Materials for Rust & Corrosion Removal
- ☐ Turco Steam Cleaning Compounds
- ☐ Turco Cold Tank Cleaning Compounds
- ☐ Turco Hot Tank Cleaning Compounds

*Name*_____

*Company*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

Announcing!

Interchemical finishes

A NEW NAME THAT BRINGS TO THE FINISHES FIELD –

1 146 Years of Finishing Experience.

2 The combined knowledge and research facilities of Ault & Wiborg, Murphy, Interchemical Corporation.

AULT & WIBORG CORPORATION FOUNDED 1878

MURPHY VARNISH COMPANY FOUNDED 1866

There's a new name on the product finishes horizon today, of which you'll be hearing a great deal in the future . . . "Interchemical Finishes." This new name is the result of the consolidation on November 1st, 1945 of the Ault & Wiborg Division of Interchemical Corporation and the Murphy Finishes Corporation into a single division, Interchemical Corporation Finishes Division.

What This Means To You — The consolidation of these two Interchemical units will bring to the industry, under a unified activity, a complete finishes service based on an extensive background of successful and diversified experience. This experience, covering an aggregate of 146 years, encompasses every phase of the product finishes field and includes metal finishes, wood finishes, metal decorating, can and drum linings, cable finishes, grain reproduction finishes, transportation finishes, household paints and specialties.

Operating as a single unit, the Finishes Division will have the benefit of the research facilities of both Ault & Wiborg and Murphy augmented by the fundamental research program of Interchemical Corporation. It will also have a nation-wide integrated network of factories, warehouses, laboratories and service stations.

All of the famous, established products formerly sold under the names of Ault & Wiborg and Murphy will now bear the designation, "An Interchemical Finish."

Through this consolidation, Interchemical Corporation is placed in a position to give to the product finishes industry a service which in scope and experience is second to none.

Starting now, remember—To give your product a good start give it "An Interchemical Finish."

Interchemical Corporation

Finishes Division

350 FIFTH AVENUE, NEW YORK 1, N. Y.

FLYING for the A.T.C., hundreds of Douglas 40-passenger C-54's make round-the-world trips every week. On flights like these, passengers expect the *comfort* of dependable heat —they *get* it by the use of Janitrol Whirling Flame Aircraft Heaters.

Heat for the cabin is provided by two 100,000 Btu Janitrols which can be operated together or as separate units depending upon requirements. Cockpit is warmed by a single 40,000 Btu unit operating independently of the cabin heaters. Motor driven blower supplies air for ground operation; ram air is used when in flight.

More than 3000 Janitrol combustion type heaters were installed in Douglas C-54's for wartime flying. The proven performance of these heaters, operating under the severest kind of flying conditions, leads Douglas to specify Janitrol equipment for cabin heating and thermal anti-icing applications on the new C-74 Globemaster.

Compactness and light weight saves valuable pay-load capacity. Maintenance costs are low—1,000 hours of heater operation without service is not unusual. Inspection and service are easy because of the accessibility of all Janitrol component parts.

Complete Janitrol Heating Package for DC-3 Planes Will Soon Be Available

Complete compact heating systems with all necessary controls—includes blower for ground operation.

By utilizing existing DC-3 duct work, installations can be made quickly and economically.

These new Janitrol systems were designed especially for DC-3's, to improve passenger comfort and to reduce heating maintenance costs. All component parts have been proven in military and transport service.

Janitrol

AIRCRAFT HEATER DIVISION • SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

FOR AIRCRAFT ENGINES . . . AIRCRAFT SPARK PLUGS

CERAMIC

CERAMIC

CERAMIC

CERAMIC

CERAMIC

Ceramic

CERAMIC

Ceramic

CERAM

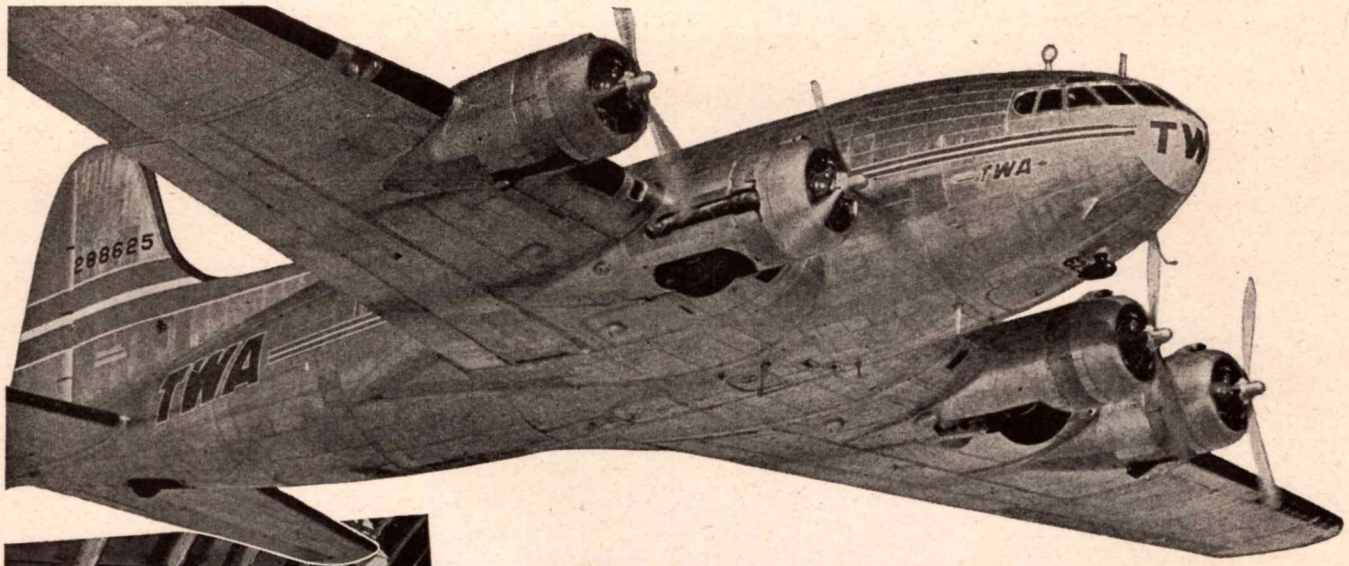
The BG trademark has symbolized the highest development in aviation spark plugs for more than a quarter of a century. BG spark plugs—both ceramic-insulated and mica-insulated—are designed and manufactured to combine utmost reliability with the economy of long life and efficient, trouble-free performance.

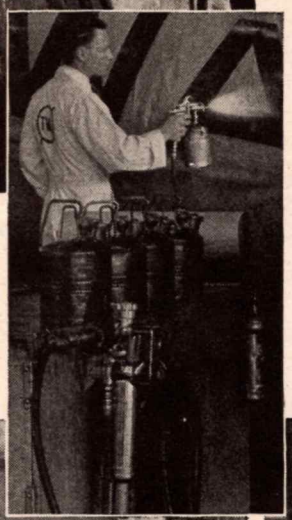
BG

THE BG CORPORATION

136 W. 52nd St., New York 19, N. Y.

Manufacturers of both ceramic-insulated and mica-insulated aviation spark plugs. Contractors to the United States Army, Navy and Coast Guard and Aircraft Engine Builders.





Chosen by Major Airlines

TWA used DeVilbiss Equipment

to speed reconversion of "honorably discharged" Stratoliners

Transcontinental and Western Air, Inc., chose DeVilbiss Equipment for quick reconversion of their Stratoliners, released by the Army Air Transport Command.

And DeVilbiss Equipment helped in many ways to get these big 4-engine Boeings back into civilian service quickly. TWA is now using this equipment—

To apply sound deadening materials for wall insulation.

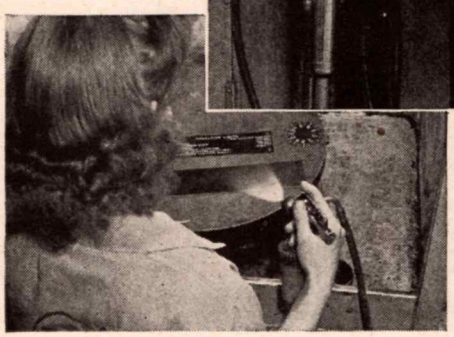
To coat irregular surfaces of cylinder-heads with heat-resisting material.

To spray clear lacquer on instrument panel parts.

To paint TWA insignia.

DeVilbiss Equipment is used by the leading airlines for many other service operations, such as waxing planes, degreasing engine parts, doping fabrics and paint conditioning.

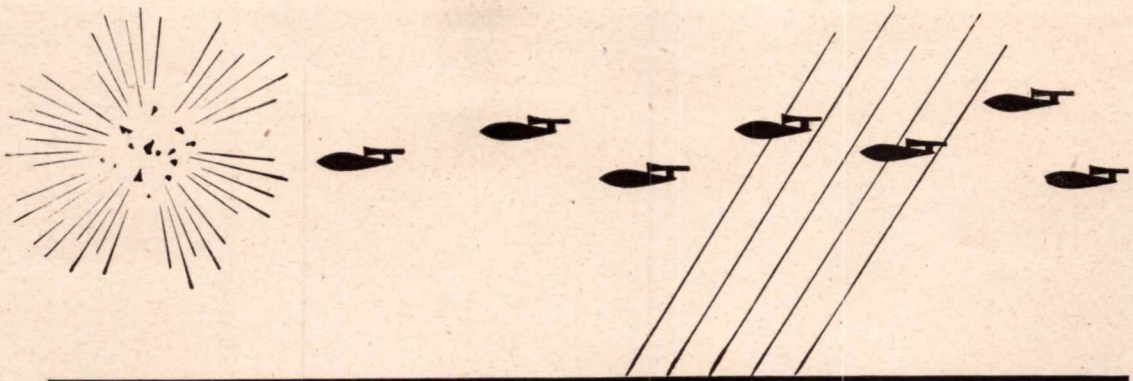
Ask your aviation supply distributor for details about the full line of DeVilbiss air-using and air-handling equipment and how it can help improve your operations.



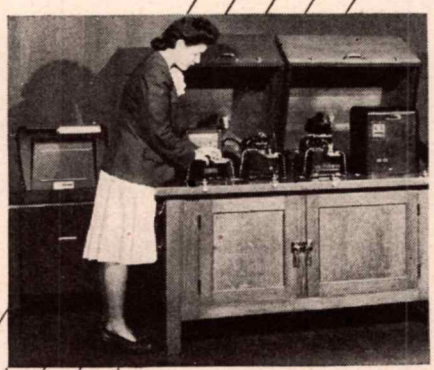
THE DEVILBISS COMPANY
TOLEDO 1, OHIO
Canadian Plant: WINDSOR, ONTARIO

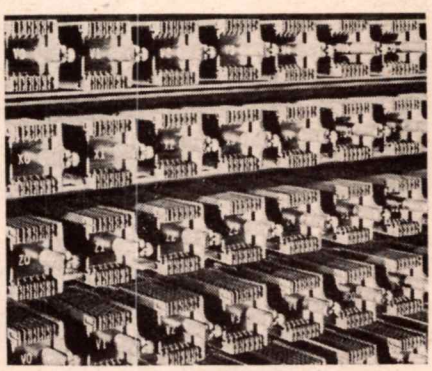
DE VILBISS
Spray Systems

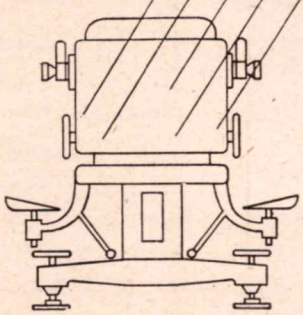
SPRAY EQUIPMENT • EXHAUST SYSTEMS • AIR COMPRESSORS • HOSE & CONNECTIONS



Target practice with Relays and Keys







(Left to right) The operator punches the problem data on tape, which is fed into the computer. The solution emerges in the teletype receiver. Relays which figure out the problem look like your dial telephone system.

In designing the gun-control systems which shot down enemy planes, Army ballistic experts were faced by long hours of mathematical calculations.

So Bell Laboratories developed an electrical relay computer. It solved complicated problems more accurately and swiftly than 40 calculators working in shifts around the clock.

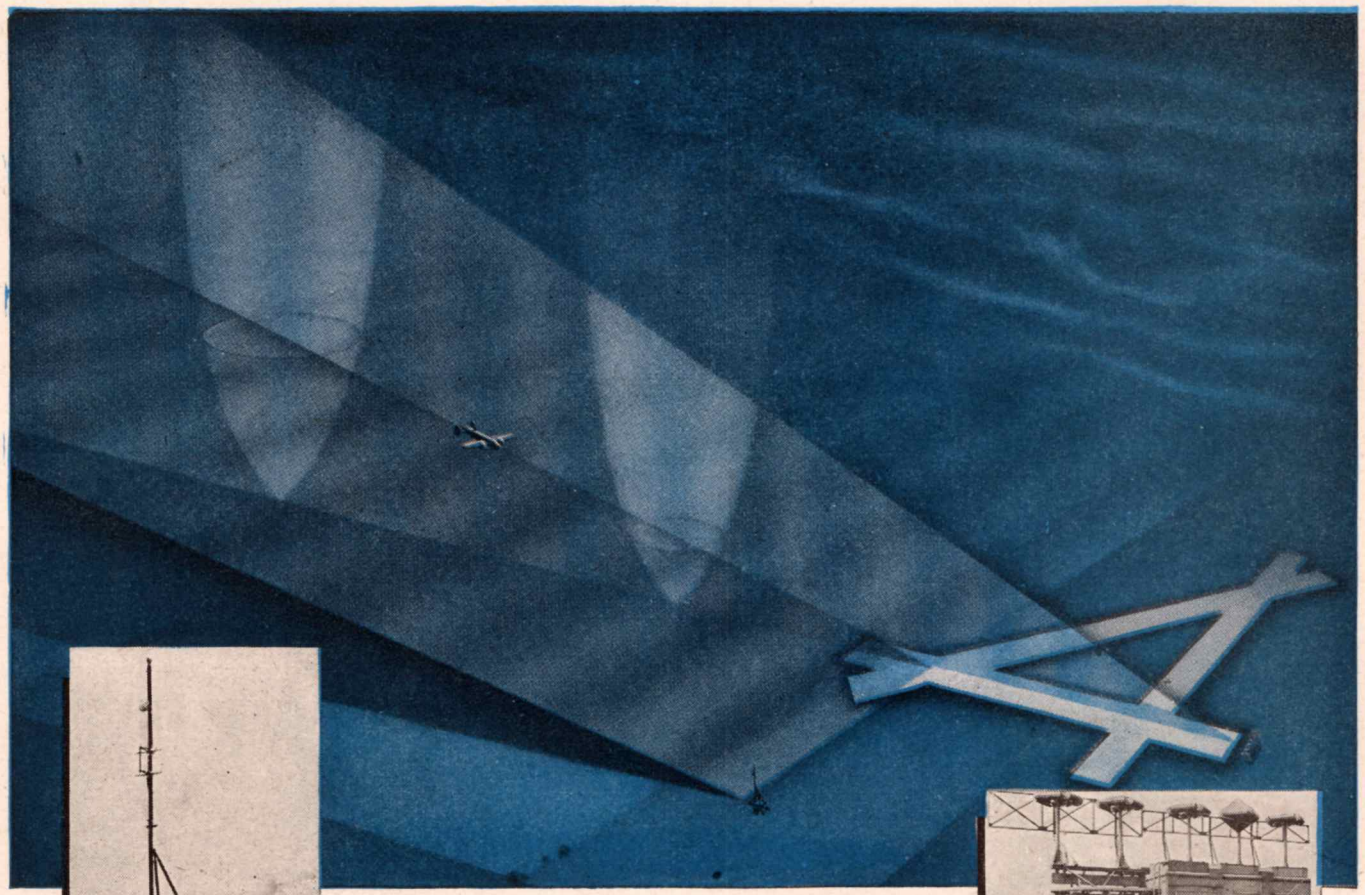
Resembling your dial telephone system, which seeks out and calls a telephone number, this brain-like machine selects and energizes electric circuits to correspond with the numbers fed in. Then it juggles the circuits through scores of combinations corresponding to the successive stages of long calculations. It will even solve triangles and consult mathematical tables. The operator hands it a series of problems with the tips of her fingers – next morning the correct answers are neatly typed. Ballistic experts used this calculator to compute the performance of experimental gun directors and thus to evaluate new designs.

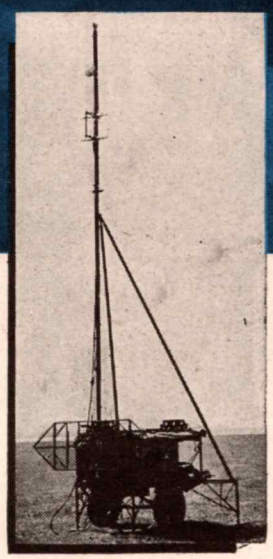
In battle action, Electrical Gun Directors are, of course, instantaneous. Such a director helped to make the port of Antwerp available to our advancing troops by directing the guns which shot down more than 90% of the thousands of buzz bombs.

Every day, your Bell System telephone calls are speeded by calculators which use electric currents to do sums. Even now, lessons learned from the relay computer are being applied to the extension of dialing over toll lines.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE





FTR Glide Path Transmitter (Air-Transportable Army Type)

FTR Localizer Transmitter-Truck Mounted (Army Type)

STANDARD . . .

Federal's INSTRUMENT LANDING SYSTEM

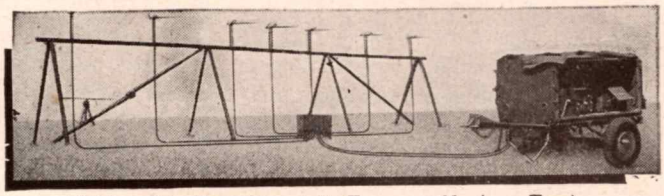
When visibility over an airport shrinks . . .

Here's the instrument landing system, adopted as *standard* by the Army and Navy, that provides the sure and accurate pathway to earth...developed and manufactured by Federal . . . operated the world over.

The pilot, guided by his cross-pointer indicator, flies on the intersection of two radio beams . . . one, a vertical pattern set up by the localizer transmitter which keeps the plane centered over the runway . . . the other, a horizontal pattern set up by the glide path transmitter which brings the plane to its fine-point landing.

Countless perfect instrument landings by skilled American airmen prove the reliability of Federal's Instrument Landing equipment . . . the result of a decade of intensive research . . . an important contribution to the war . . . with even wider service promised for the coming age of the air.

For the finest in radio aids to aerial navigation and communications equipment . . . see Federal first.



FTR Localizer Transmitter (Air-Transportable Army Type)

FEDERAL TELEPHONE & RADIO — FTR

ARMY E NAVY M

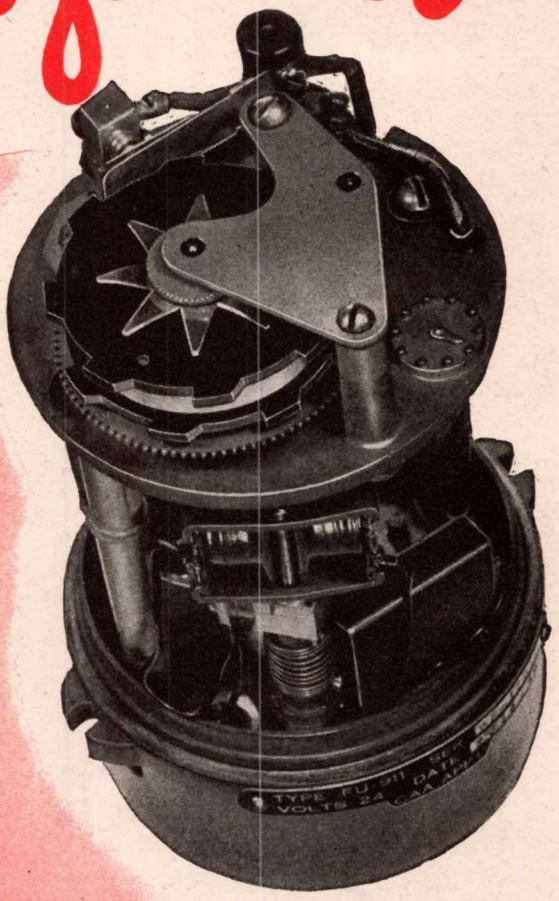
Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

Newark 1, N. J.

SPLITS SECONDS "just so"

THE W&T CONSTANT SPEED MOTOR MECHANISM meets precision standards



Type FA-121 for 12 volt operation
Type FA-122 for 24 volt operation

FOR coding, keying, monitoring, programming, or other timing applications this instrument, operating at a constant speed, regardless of voltage variations as great as ±20%, permits accurate timing to hundredths of a second.

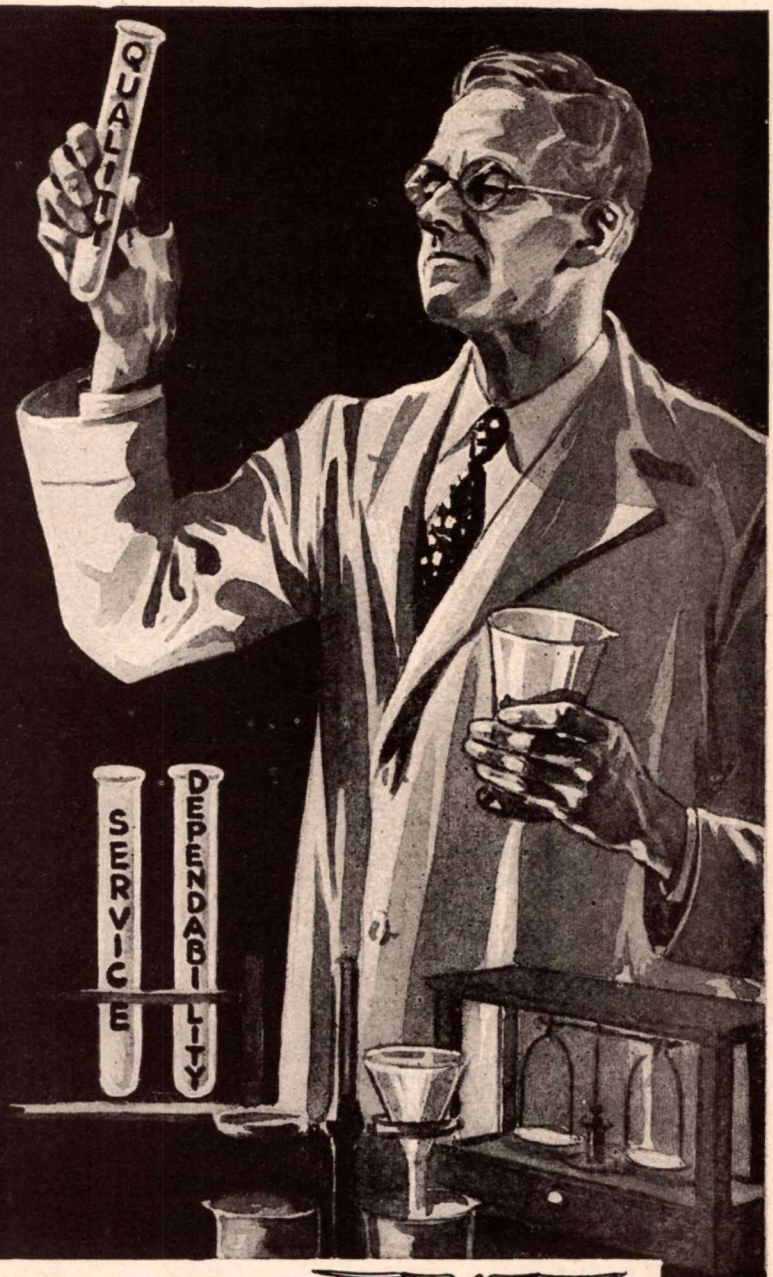
With a current input of only 0.003 milliamperes, the motor delivers 1800 gram inches per minute, a feature of especial importance in battery powered systems.

Interchangeable cams permit the use of any desired timing characteristic for two or more separate circuits.

Write for Technical Publication 234

WALLACE & TIERNAN
PRODUCTS, INC.
BELLEVILLE 9 • NEW JERSEY

WHAT LEADERSHIP IS MADE OF



● Some say one thing — some say something else. The men who buy and use FLIGHTEX attribute FLIGHTEX leadership among airplane fabrics to the Quality, Service and Dependability they find in every yard. *No wonder each year more manufacturers buy more FLIGHTEX than any other airplane fabric.*

World's Premier Airplane Fabric FLIGHTEX FABRIC

FLIGHTEX

FLIGHTEX FABRICS, INC. • 93 Worth Street, New York 13, N. Y.

Leading Manufacturers of Fabric and Tapes for the Aircraft Industry

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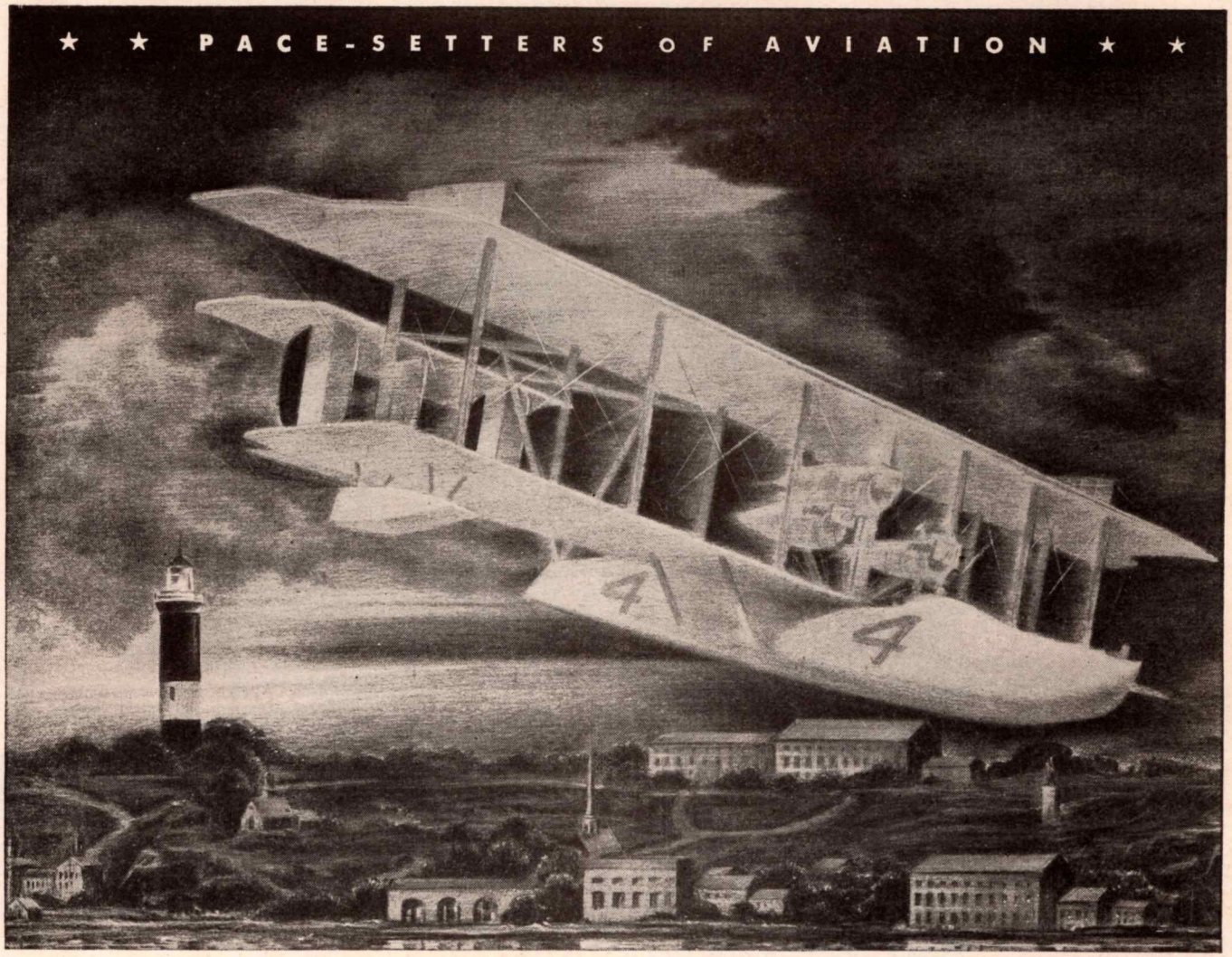

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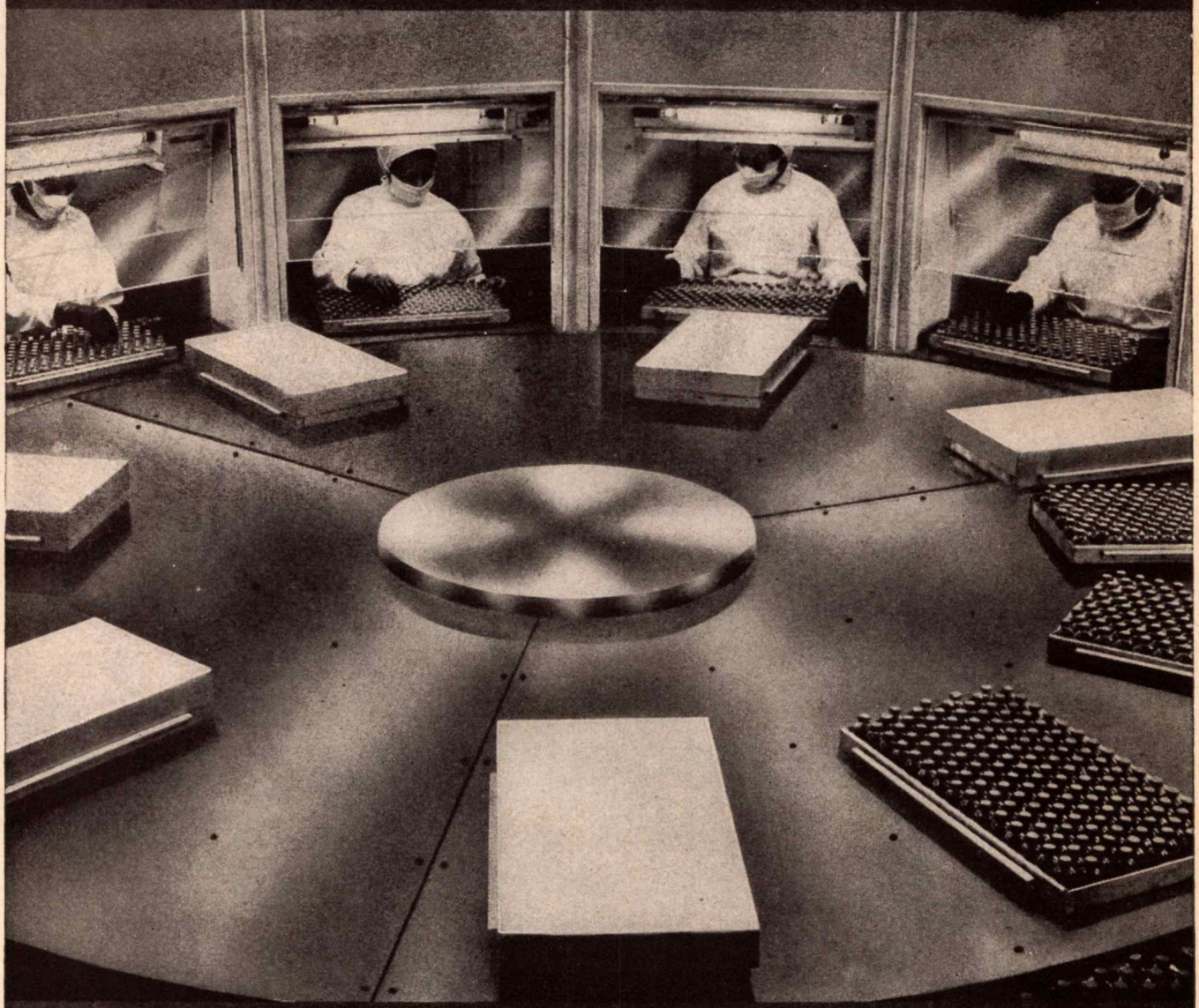

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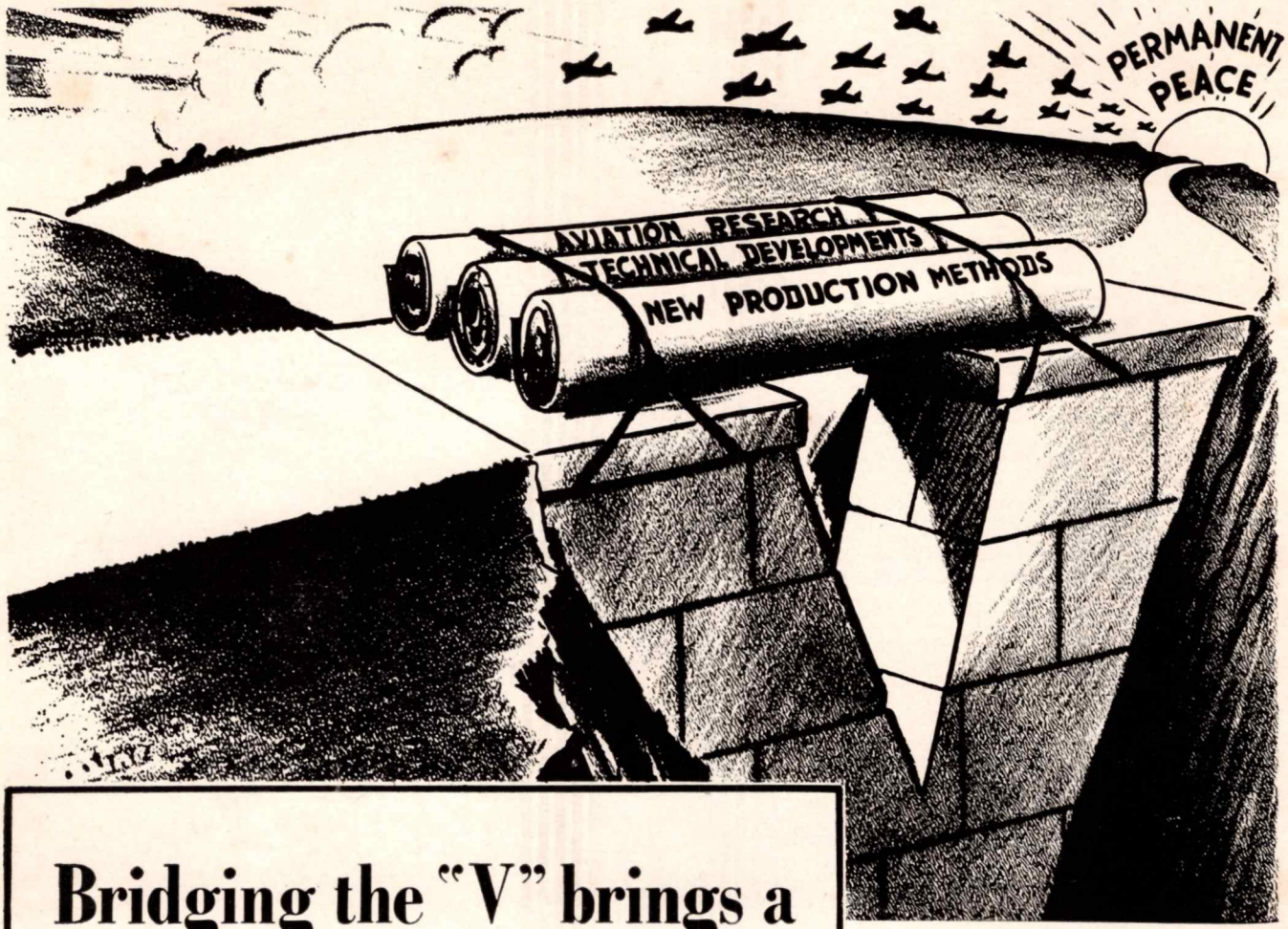

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PACEMAKER OF AVIATION PROGRESS

The Airplane in National Defense

GENERAL WILLIAM MITCHELL, D.S.C., D.S.M.

Formerly Commander of Air Forces, A.E.F. and Director of Military Aeronautics, United States Army

TO speak of "airplanes" in national defense as applied to an Air Force is much the same as speaking of the "rifle" as applied to an army, or the "warship" as applied to a navy. Therefore, in considering the "airplane in national defense" we must think of it as the vehicle which is the means of conveying "air force" through the air, much in the same way that a man's legs are the final analysis of land force, or the vessel is the vehicle of sea force.

National defense means the protection of the country, primarily, from outside aggression, international war, not internal disturbances for which we have police forces and constabularies.

Each nation has its special problem in national defense. We, in the United States, have a comparatively simple one. We have a compact country, rich in practically every element necessary to maintain ourselves in an international war. We are the most self-contained country in the world, and should be able to defend ourselves against the world, providing we apply the elements which the Almighty has given us.

The Term "War"

The term "war" signifies the condition which results when one nation attempts to impose its will on another by physical means. The methods employed are directed towards paralyzing the ability to make war on the part of the enemy, while at the same time protecting one's own military power.

If the vital centers of the opposing nation are destroyed, or made incapable of carrying out their part in the upkeep of the people, resistance is no longer possible, and capitulation or surrender is the outcome.

According to ancient methods of warfare, these vital centers of a country were protected by groups of men put out in front of them, to prevent other men from moving along the ground and possessing themselves of the vital places. People then fought in only one dimension, the surface of the earth, which was the decisive area, and the surface of the sea, which was an auxiliary area. Now military operations have been carried: (1) into the air, which covers the whole earth with a highway ten miles deep; and (2) under the sea, which gives the maximum amount of concealment to the vessels operating in the water.

Each succeeding military epoch has seen an improvement in the mechanics of conducting war. Each improvement in weapons has given the defense more power to arrest the advance of the opposing force. Sixty years ago, in our Civil War, one man well entrenched might have been able to hold off five attacking him. Now one man may be able to hold off fifty.

The world can still look ahead with Billy Mitchell. This article, which AERO DIGEST obtained from the industry's outstanding champion, was originally published in May, 1927—in *The Annals* of the American Academy of Political and Social Science. It is reprinted by permission.—*Ed.*

A climax was reached in the European or World War. There the armies, after some preliminary maneuvering, sat down in a series of trenches and indulged, during four years, in an orgy of killing that merely led to the complete exhaustion of all the combatants without substantial gain to any. The armies advanced or retreated only about sixty miles during this whole time. The directing heads of the armies were entirely unable to bring about victory for either side.

Had this method of warfare been continued, it might have led to an entire extinction of what we call civilization today. Just as happened in Europe, after the fall of the Roman Empire, when with a destruction of all means for preserving the peace and maintaining a governmental organization, the known world reverted to a state of savagery which we call the Dark Ages. Armies, therefore, have become holders of ground; they cannot advance over it with rapidity to the vital centers of an opposing nation and bring about a quick and decisive victory. Air forces are the means of going straight to the vital centers of the opposing side and paralyzing them.[1]

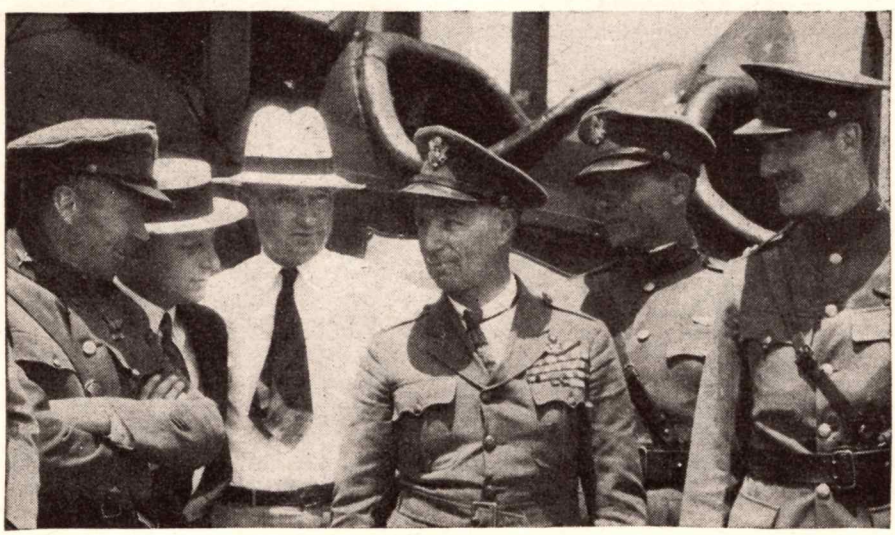
Ships at Mercy of Air Forces

On the sea, the surface vessels are entirely at the mercy of air forces with the airplane. The greatest battleship is even more vulnerable than the smallest torpedo boat. This is because the battleship cannot conceal itself, is comparatively immobile and inert as far as air power is concerned, and is possessed of no adequate means of defending itself against air power. Therefore, the surface fleet, as a means of controlling the sea in a contest between two great industrial nations, has lost its value.[2] What main operations are carried on in the water in the future will be handled by submarines which proved decisively in the last war what their value is. The keeping of large surface navies, by some of the great powers at present, is merely a result of inertia, and the maintenance of the immense interests, both personal and financial, which man the navies and supply and sell the equipment to the governments.[3]

The airplane is now the arbiter of a nation's destiny. There are no longer frontiers, in the old way. A nation's frontier now is a blanket of air ten miles thick, laid entirely over it.[4] To illustrate, let us consider the vital area in the United States. It lies in the triangle, Chicago, Bangor, Maine, and Chesapeake Bay. Roughly, the distances are about 750 miles on a side, or from four to six hours' flying with modern aircraft.[5] In this district are located New York, Philadelphia, Washington, Pittsburgh with all its iron, Pennsylvania with its coal and oil, the

great cities of the Middle West, Detroit with the world's motor industry, Cleveland, the railway neck or strait, as it might be termed, south of Sandusky, Ohio, where the great transcontinental lines come together, and then Chicago, the keystone of our arch of dominion. Two-thirds of all we possess as a nation—people, agriculture, manufactories, animal industry, wealth —lies there.

Suppose that New York were paralyzed. By this we mean made uninhabitable for its population so they would have to leave it and go to the open fields and forests fifty or a hundred miles away. The population of the area within twenty-five miles of New York is about as great as that of all Canada, almost twice that of Australia and more than the population of some of the countries of Europe.[6] A few shells, gas, explosive or incendiary



Gen. "Billy" Mitchell (center), about the time that this article was written

landed in Manhattan would cause a complete evacuation. It is not necessary to destroy the physical structure of a city today to paralyze it. That was a method of ground armies because they could do nothing else.

Aircraft can stand off a hundred or more miles and launch air torpedoes carrying hundreds of pounds of gas, explosive or fire-making compounds, and hit a place like New York practically every time.[7] The air torpedo is like an airplane controlled by gyroscopes which will pilot it in the direction and for the distance desired. In case the wind deflects it from its course it may be corrected by radio or wireless control. Either large airplanes or dirigible airships, such as the *Zeppelin*, that last crossed the Atlantic, are able to carry these.

Airplanes do not have to fly over a place to attack it. Not only may they use the air torpedo but they can also put wings on their bombs which will allow them to glide for many miles to their objective.[8] The variety and power of weapons that aircraft can carry are the greatest that the world has ever seen. Poison gas can be sprayed over fields and agricultural areas so as to kill the vegetation, and prevent its being used for long periods.[9] All livestock, as well as people, may be destroyed in a similar manner.

Suppose that New York, Chicago, and the railways south of Sandusky were paralyzed. It would disrupt our whole existence as a nation. Suppose next that Pittsburgh, Detroit, and the Mackinaw Canal were put out of business, and that the air attacks against these places were continued so as to keep them paralyzed. Within a very short time the nation would have to capitulate or starve to death.[10]

These places can be attacked directly through the air from Europe now, and either directly or with auxiliary bases from Asia. Such is the carrying capacity and power of navigation of aircraft that can be constructed at this time.

Armies and navies are entirely powerless to stop such proceedings, because no weapon or device operated from the ground is able to stop or even remotely hinder air operation.[11]

Suppose that New York and Philadelphia were the vital centers of two states at war with each other. Suppose that New York had a tremendously strong army but a very weak air force, but that Philadelphia had a very weak army and an immense air force. The New York army would take up its march towards Philadelphia. It would make two and one-half miles an hour. The Philadelphia army would entrench near the Delaware River where fifty times its number of men on the ground could not dislodge it. The Philadelphia air force would launch a gas and explosive bomb attack against New York. It would take one hour and a half to fly there, and forty minutes to make the air attack.[12]

Armies Would Merely Hold Ground

New York, the air fields of its air forces, and probably its army would be destroyed in less than a day, and the war would be over. The armies would merely hold the ground. If they were too large they would eat up so much food, and require so much equipment, that it is conceivable that they might take so much vital power away from the population and air power as to almost defeat themselves.[13] A nation today can very easily have too large an army.

Suppose that this country were menaced by a European nation possessing an immense navy, and that we had no navy but a well-ordered air force. We can exist, fortunately, without outside assistance; in fact we would feel the lack of very little no matter whether we had all the sea communications or not. Should the opposing surface navy venture out into the sea it forms the easiest object of attack and destruction which has ever been presented in warfare. In fact, in a modern war these vessels would probably be destroyed before they ventured forth from their harbors.[14] Aircraft using the air torpedo, the water torpedo, the gliding bomb, the dropped bomb, gas curtains, mines and gun fire are able to destroy and sink these leviathans with comparatively little effort in lives and expenditure.

The submarine alone, of a navy's devices, forms a difficult problem for the airplane to handle. Concealed beneath the surface of the sea it is difficult to find during the day: cruising or lying quietly on the surface of the sea at night it is inconspicuous compared to the great surface vessels. Aircraft, however, provide the best means of defense against submarines,[15] except submarines themselves. As a means of defending our coasts against the old-fashioned naval attack, aircraft are an absolute and positive protection.[16] In fact no nation would be foolish enough to send a navy to certain destruction against a nation well provided with an air force.[17]

What is the defense against an air force, then, it may be asked? The answer is that there is no absolute defense against an air force. The air is such a tremendous place that it is practically impossible to find each and

every aircraft that an enemy possesses. An air force, however, is the only means of meeting an opposing air force. In war the nation that gets in the first great air blow amidst the enemy is the one that will win.[18]

Should war be declared tomorrow between England and France, France would launch a night attack against London with a thousand airplanes tomorrow night. London is only forty minutes' flight from the French coast. England would have to attack Paris two and a half hours away with less than half the airplanes that France has. The attack would be decisive; London would be destroyed. In a couple of weeks the war would be over. England's army and navy would do her no good.[19] She knows this full well, but on account of her geographic position and the configuration of her insular country she cannot escape it.

The use of aircraft in war might be likened to the "punch" which two prize fighters are able to deliver. We might consider that neither had any "defense" and could hit the other at will. One with the "punch" would "land" no matter how the other hit, and the fight would be over. Never has there been any power or force in war where it has been as important to get in the first "punch" as is the case with air power. In the old days people might pick up pitchforks and flintlock muskets and defend themselves. Now to construct the equipment for air power takes years of preparation by men that know what it is all about.[20] Armies and navies are entirely incapable of either visioning what it is or carrying it out. The United States never sent a completely equipped airplane of American manufacture to the War in Europe.[21]

The contest now between the great nations, to protect their trade, their institutions and their national integrity, is not huge armies, not tremendous and costly naval bases scattered over the world, but the development of *airpower, air bases* and *aircraft.*[22]

The unusual thing about air power is that a commercial air transport airplane is practically as useful as what is termed a military plane. One may be transformed into the other by merely loading the weapons of destruction, bombs and bombsights, on it. That is the work of a few minutes.[23]

England and France thought they were clipping Germany's fighting wings when they put into the Treaty of Versailles that Germany should produce no military aircraft. Germany has built a great "civil" aviation. Germany has the greatest dye factories and chemical factories in the world. These factories can be transformed into poison gas sources in a day. The "commercial" airplanes can be loaded and dispatched to London or Paris overnight and inflict incalculable harm. Germany today holds "up her sleeve" the power of the greatest military surprise of the ages.[24] More than the surprise of her *Big Berthas,* more than her gas, and more than the great mobility of her troops in the last war.

Airplanes and synthetic chemistry hold the future national defense in their hands. The nation that has these will dominate, because it will thereby be able to exist.[25]

Therefore, when we consider "the airplane in national defense," as this article is entitled, we must look to the future, not to the past. We must relegate armies and navies to a place in the glass case of a dusty museum, which contains examples of the dinosaur, the mammoth, and the cave bear. They still must be kept, because we must always maintain something that is still sure and useful in its particular sphere as the dinosaur was. But we must not entrust our national defense to these honored but obsolete services, because they will surely bring us to the Scilla of the fixed and narrow routine of the armies, and the Charybdis of the "brass hats" and organized buncombe of the navies.

The airplane is the future arbiter of the world's destiny.

---

[1]Beginning in 1939, when the Nazis invaded Poland with their sensationally new "blitzkrieg" techniques, Hitler repeatedly demonstrated the truth of this observation.

[2]A list of capital ships lost in World War II, published in *Aero Digest* November 1, 1945, shows that 70% were lost through air attacks.

[3]Among nations where coastal defense is of paramount importance, the naval tradition of might in sea power persists—notably England.

[4]The General was mindful of the fact that high elevations would require protection, too, although aviation in his time was virtually all at relatively low altitudes.

[5]This time estimate was correct in 1927.

[6]According to the latest official census, the population of New York's metropolitan area is 11,690,520 persons. That of Canada is 11,506,655, and of Australia 9,882,548.

[7]In 1944, when the RAF was blasting V-bomb installations on the so-called "invasion coast" in a frantic effort to end the latest Nazi terror weapon, it was discovered that large numbers of these robot torpedoes were being launched also from German planes.

[8]To be sure, the concept of a winged bomb was old. John Emerson wrote and produced a motion picture entitled *The Flying Torpedo* for Triangle Film Corporation in 1915, in which such missiles were launched from a runway.

[9]This allegedly was a method of the Nazis in several invaded countries.

[10]An instance of such tactics was Hitler's drive on "Russia's breadbasket" in the Ukraine.

[11]There has been much recent talk of secret devices, supposedly perfected during World War II, which are said to be able to detonate bombs at a distance, to halt planes in midair and otherwise to counter an invading enemy on the wing. However, without public demonstration to establish the facts, the General's contention must still hold.

[12]Here, again, the General refers expressly to flight conditions in 1927.

[13]The civilian rationing program remains as a convenient reminder that it takes huge quantities of food, clothing and other commodities to maintain an army in the field.

[14]The Japs were so sensible of this that, during 1944, practically no capital ship of their navy appeared in the battle areas of the Pacific.

[15]German U-boat depredations along the sea routes in 1940 almost brought victory to Hitler; but the use of a convoy system with escort planes enabled Churchill to announce in September, 1941, that the number of ship replacements had at last exceeded the sinkings.

[16]The question of the respective merits of land-based planes *vs* carrier aircraft was not a subject of debate in the General's time; the aircraft carrier's value was still largely hypothetical. The first takeoff from a battleship was Eugene Ely's flight from the bow of the American cruiser *Birmingham* at Hampton Roads in November, 1910.

[17]Post-war releases of Nazi secret war plans reveal that Hitler's proposed invasion of England, after Dunkirk and with men and equipment fully ready, was abandoned wholly because of the stubbornness with which the RAF held to its mastery of the sky.

[18]Hitler's blitzkrieg strategy held to this as a cardinal point; and its success was evinced first in his invasion of the Low Countries. The General's statement still represents the considered opinion of most aviation authorities.

[19]The obsolescence of armies and navies in the old sense, unsustained by air power, was demonstrated once and for all in the rout of Allied forces culminating in Dunkirk and involving the successive collapses of Denmark, Norway, the Netherlands, Belgium, and France.

[20]In response to any suggestion that the air equipment which won the decisive victories in World War II did not take long to prepare, authorities will be quick to assert that most of those victories were accomplished by the grace of God and not by advance planning.

[21]This was true in 1927. In World War II, of course, American planes were exported in large numbers.

[22]The present stress by many nations on post-war air power is healthy indication that the trend of official thinking is now along lines of the General's recommendation.

[23]The celebrated *Flying Fortress,* in its original form, was intended for use as a commercial transport until military needs ruled otherwise.

[24]When General Mitchell wrote this, Hitler was still laboring in obscurity; the General probably never heard of him. Nevertheless, at this early date, he clearly saw the sham under which Germany was making ready for war.

[25]Only one who has lived through the introduction of the atomic bomb can appreciate the startling accuracy of this prophecy.

Guest EDITORIAL • • •

Let the Bird Grow Up Before You Pluck It

WILLIAM A. MARA

THE "bird" referred to in the title of this editorial is little more than an awkward, but lusty, fledgling. Its name is nonscheduled flight.

Nonscheduled operations for hire are much in the aviation headlines at the moment. For some years, operators have been conducting a small but useful business in the transportation of people and occasional rush items of freight, for the most part to localities not served by scheduled airlines. They have been aided in their development by a specific Federal provision exempting them from certification and economic regulation.

The question is now being publicly debated, "How far shall nonscheduled operators be subject to regulation?" The operators themselves feel that if considerable number of the rules now proposed are adopted, their airplanes for the most part will be grounded. The birdling will die before it can grow its full plumage.

The outstanding fact about nonscheduled flying today is that it is a relatively small business and there are few statistics or data on which to judge it.

One trade association estimates that there are some 2700 airplanes in the country engaged in flying people and goods for hire, most of the planes being the one- to four-passenger kind. Government surveys have found that some 75 aircraft service stations are engaged in contract carrier operations, and approximately 450 owners of private airplanes are carrying passengers for money. None of these estimates and surveys are complete enough to give us an accurate picture of nonscheduled flight.

A better survey of the field is obtained by talking to a few operators and listening to hangar gossip. One operator flies a party of hunters to South Dakota to shoot pheasants. Another flies a party of vacationers to a northern lake. Another takes a business man to a city where no airliner stops. Still another hurries a badly needed machine part to a plant in an outlying town. An operator in one of the larger cities reports that he regularly has about three charter trips a week, using twin-engined equipment.

These, obviously, are crumbs left by the scheduled airlines. They represent only a small percentage of the income of the operator himself, whose main revenue comes from flight instruction, or sales and service. For the most part, nonscheduled operations are taxi trips serving routes and destinations not covered by the regular lines.

But the nonscheduled operators, while they realize that their present business is in a minor key, as compared to more established types of transport, feel that it has glowing possibilities.

Many of them now use small single-engined planes while the more prosperous use twin-engined airplanes with a capacity of four or five passengers and the pilot. Some of them look forward to buying DC-3's.

The variety of business small operators hope to develop stirs the imagination. They see businessmen using the air taxi more and more to cover a thousand-mile circuit. They see a big summer business to beaches and remote lakes and in chartered vacation tours. They foresee many short hops between small towns in which the passenger is the country doctor or a visiting relative.

Not Competing With Airlines

In all this, they never visualize themselves as competitors of established airlines. For one thing, their rates are too high. Charter operators charge anywhere from 25¢ per round-trip mile for small planes to 75 cents per round-trip mile for larger equipment. Charges when they rent aircraft solo run from $6 per hour on up. Their rates are far above airline rates, just as taxi rates are higher than city bus rates.

For another thing, they see themselves carving out a prosperous business in areas where scheduled flying doesn't serve. There's plenty of room for a prosperous future, they feel, without seriously paralleling or duplicating existing transport.

Whether their dreams are well founded or not is beside the point. It would seem to be in the public interest to let the operators discover their own places in the transportation scheme, without restriction.

While nonscheduled operators seem to be developing more along the lines of aerial taxis than aerial trucks, there is a lesson for the American public in the experience of the trucking industry in its early days.

Trucking developed in the years just after World War I. As the Department of Commerce points out, trucking was pioneered by thousands of small operators. There was no restriction. Any man could buy a truck and haul a load from city to city. These early enterprisers ventured out onto the highway, looking for a fee, and in the process they explored and set new patterns of transportation. The vigor of their competition reduced rates, created types of service that had never existed before, and brought benefits to many communities previously without other forms of transport.

Suppose these early truckers had been Federally-restricted as to the types of trucks they could use, routes they could cover, rates they could charge. It seems likely that many hopeful young men would have thrown up their hands and decided reluctantly to go into some other business.

Like the early truckers, pilots are now buying a plane or two and offering themselves for hire. Just as the truck was an investment small enough to be managed by one man, so the airplane is within reach of the average man's resources. There are thousands of returning military flyers eager to try their hand at a charter service based at the hundreds of new airports going into service throughout the country.

It will take the imaginative efforts of thousands of unhampered enterprisers to discover the true public uses of nonscheduled flight. Some of the proposed regulations would hinder the process considerably. Certain aircraft requirements, for example, call for types of equipment and performance that would automatically ground many of the planes now in charter service.

Limitations as to operating area and range would hamper the energetic operator who is trying to discover his markets in a new and unprecedented business.

One proposal suggests that the operator be permitted to fly only between his principal base of operation and other points, thus limiting his freedom to explore new markets. Another proposal suggests that the nonscheduled operator be permitted to make no more than 10 trips per month between the same pair of points now served in reasonably direct fashion by scheduled air carriers.

Such limitations of route and frequency of trips will prevent the public from receiving to the full the possibilities of nonscheduled operation.

The factors to remember when we consider the question of economic regulation are these:

(1) We do not know enough about nonscheduled operation to regulate it intelligently. This is brought out by the CAB examiners themselves when they state: "There are as yet no data available which will permit an accurate appraisal of the nature and volume of the transportation services offered by so-called nonscheduled carriers. This applies not only to previous years, but also with respect to estimating the potential for a reasonable period in the future."

(2) The airlines agree that present nonscheduled volume, and any volume anticipated for the near future, is not great enough to constitute an economic threat.

(3) Nonscheduled rates are higher than airline rates, and will remain so because the nonscheduled operator cannot count on a return haul.

Restrictions Retard Development

(4) Nonscheduled operators tend to serve areas not served by scheduled carriers. By doing so they create new passengers for the airlines.

(5) Men in the armed services will want a chance to develop nonscheduled operations, with as few restrictions as possible.

With all these points in mind, it seems that the public interest would best be served by withholding all forms of economic regulation of nonscheduled aviation that do not already exist. General Exemption Order, Section 292.1, providing freedom from regulation, may well be continued until there is actual and conclusive evidence that such regulation would be desirable and in the public interest.

Little was lost and much was gained by allowing the motor carrier industry, including taxicab service, to develop without restriction. In the end, these services proved far more useful than anyone suspected in the early days of their development. History shows that where there is a new, flexible, and untried form of transport, the best procedure is to let it develop freely. It hardly seems wise to teach a young bird to fly by clipping its wings.

About the Author

William A. Mara has devoted most of his business life to aviation, with the emphasis on personal aircraft. As Detroit's first aviation commissioner, he organized and managed the first two Airplane Reliability Tours for the Ford trophy.

In 1925 Mara became associated with the late Eddie Stinson in the formation of the Stinson Aircraft Corporation, and with Stinson developed the first personal plane to incorporate such improvements as wheel brakes, the electric starter and an enclosed cabin. During this period he played a leading role in the organization of Northwest Airlines and Braniff Airlines.

Mara at present is in charge of all Bendix Aviation Corporation affairs related to personal aircraft. As a member of the Nonscheduled Flying Advisory Committee of the CAA, he has followed closely recent trends in the regulation of commercial nonscheduled flight.

He holds a commercial pilot's license and has recorded approximately 3600 hours of flight time.

Gallery of Aviation's Frontiersmen

JOHN HETTICH

MY personal interest in aviation was aroused when, as a boy of twelve, I read a thrilling account concerning Curtiss's capture of the Gordon Bennett speed trophy at Rheims.

On the 4th of July of the next year I hitchhiked twelve miles by horse and buggy to Louisiana, Mo., in expectation of seeing Tom Benoist, of St. Louis—billed as a world-famous aviator—make an exhibition flight. Tom was in reality still a novice pilot; his *Benoist* biplane was only Hillery Beachey's rebuilt *Gill-Dosch;* and the sum total of it all was that no flight was made. Greatly disappointed, I returned home to Bowling Green to join two other lads in building something which would really fly high, fast and far.

The First Personal Plane

At home a file of *Scientific Americans* was available. They continued numerous pictures and information concerning contemporaneous aircraft. With the background of technology quickly acquired therefrom, we three youthful designers decided to combine the best features of the Wright, Curtiss and Farman machines into something to be called the "Hettich-Freeman-Ledford No. 1."

Throughout the fall we slowly fashioned pine planks into spars, bundles of laths into ribs and undoped muslin into wing-covering, bracing the whole contraption with piano wire. Unfortunately, our combined capital of five dollars was insufficient to purchase an Elbridge or any other type of motor. Consequently, we remained grounded, and consequently no daring feat of airmanship by my associates and myself materialized.

During the winter, John Hettich, Sr., paid us the production cost of the contraption as it stood, and took it over for conversion into a brooder for baby chicks.

The machine did not fly, but it served the purpose of whetting my growing interest in aviation—further accelerated, when Curtiss built his celebrated air school at North Island. I was living at Coronado then, going to high school. My mother owned the local newspaper, and, when I was given a page in it to edit, the leading subject, needless to say, was aviation.

Subsequently, during the 1912-1915 period, I did a lot of hangar flying around North Island with characters such as Lincoln Beachey, Ray Morris, John Cooper and Floyd Smith. By that time I had become too saturated with aviation ever to climb out of it, and contacts and acquaintances with the *Early Birds* came thick and fast.

This first-hand knowledge made me painfully aware of inaccuracies and omissions in articles I began to see concerning old-time flying. Many of the articles were well written, but others were chock-full of errors, such as having John Smith pilot a Curtiss pusher in 1908 or 1909—when John didn't get into the air until 1913.

As aviation becomes regularized and the industry expands, the achievements of individuals become obscured. Looking backward, on the other hand, towards the barnstorming days when aeronautics was an avocation—for men who earned their livings in "more practical" ways—those who grasped that glittering opportunity stand out vividly against their "horse-and-buggy" background.

Many of the early aviation pioneers are gone, alas—and others are going. The opportunity to collect and record mementos and anecdotes concerning them—precious, because they link us in human dignity with the Titans of yesterday—is now.

John Hettich, of San Ysidro, Calif., has undertaken this work of preservation. A lover of aviation and a worshiper of heroes, he has expended ten years gathering from exclusive and, as far as possible, from authentic living sources, a personal and unique treasure of old historic associations.

Beginning with the January, 1946, issue of AERO DIGEST, readers of this page will have the privilege of meeting some of aviation's frontiersmen in a new and stimulating way.—Ed.

Feeling that the time had come for someone to straighten out the record I began what was to eventuate as ten years of intensive research. I turned first, as a matter of course, to the shelves of the San Diego Public Library; turned next to Stanley Y. Beach; and from there on, approached all and sundry who might have any of the data for which I was in search.

I wish I could thank all of the old-timers who so patiently submitted to my interviews and answered my many letters. I have had the cooperation of such persons as Dr. A. F. Zahm, Ernest L. Jones, Augustus Post, Walter Brookins, Bob Fowler and others who know what it is all about, in checking doubtful items for possible distortions of fact. From these and other associations I have gained an "inside view" of things.

The articles to follow will contain many notable names in aviation history—some discussed at length, others in passing. Present will be John J. Montgomery, who in 1884 made the first glider flight in America. Also to appear will be Octave Chanute, whose gliding experiments in 1896 prepared the way for the Wright and Curtiss engine-driven biplanes. Samuel Pierpont Langley and Alexander Graham Bell are other names of "giants in those days."

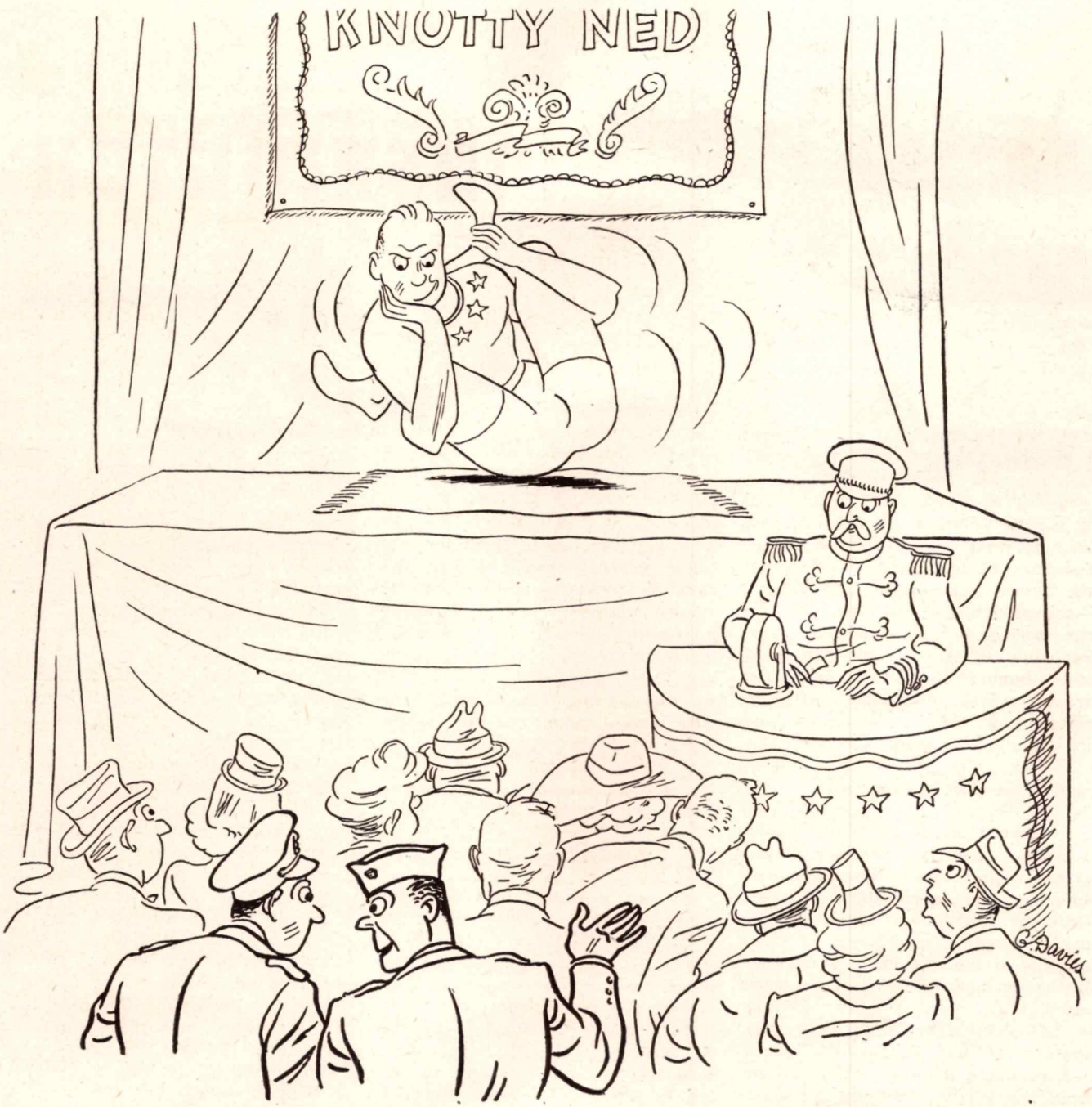
In the round-up, of course, will be Wilbur and Orville Wright, the same who—by an astute process of elimination, adaptation and invention—produced the world's first engine-propelled man-carrying airplane in 1903. Less important, but sufficiently spectacular in his own way, will be Thomas Scott Baldwin. His little airship, the *California Arrow,* thrilled thousands of spectators at the Louisiana Purchase Exposition in 1904.

Pioneers Were Many

Then there is Daniel Maloney, a truly forgotten birdman. In 1905, at a public demonstration, he cut loose from a balloon at a height of 4000 ft to prove the flying qualities of Prof. Montgomery's torsion-wing "aeroplane." Again, there are Lieut. Thomas E. Selfridge, first U. S. Army officer to pilot an airplane and, in 1908, the world's first martyr to motor-driven flight; Frank S. Lahm, American businessman and amateur balloonist who, while residing in Paris, sustained the jeers of those Europeans who thought the Wrights were "bluffing."

Included, likewise, will be Glenn H. Curtiss who, by sale of the *Golden Flyer* to the Aeronautic Society of

(*Continued on page* 121)



"He got his training in a ball turret!"

Never before in the history of flying have so many American men and women been trained to build, fly and maintain aircraft. Even discounting those who will move to other occupations during the reconversion period, we have manpower to remain secure in the air, both from a military and a commercial standpoint.

However, other nations also have great air fleets and trained personnel. The question of who will carry the world's air commerce is likely to be the subject of international bargaining for many years to come. The nation which consistently produces planes that can be operated at a lower cost will have an "edge" in such bargaining.

In developing post-war commercial aircraft, American manufacturers will enjoy one important advantage over foreign competition. The United States today can produce more high-octane gasoline than any other nation. We have the crude oil, the refining capacity, and facilities for producing large quantities of Ethyl antiknock fluid. Commercial quantities of better-than-100-octane gasoline could readily be produced.

By developing engines to fully utilize this superior gasoline, American aviation people can give U.S. commercial planes superior performance and *economy* . . . important factors in the final determination of who shall eventually have the upper hand in peaceful competition.

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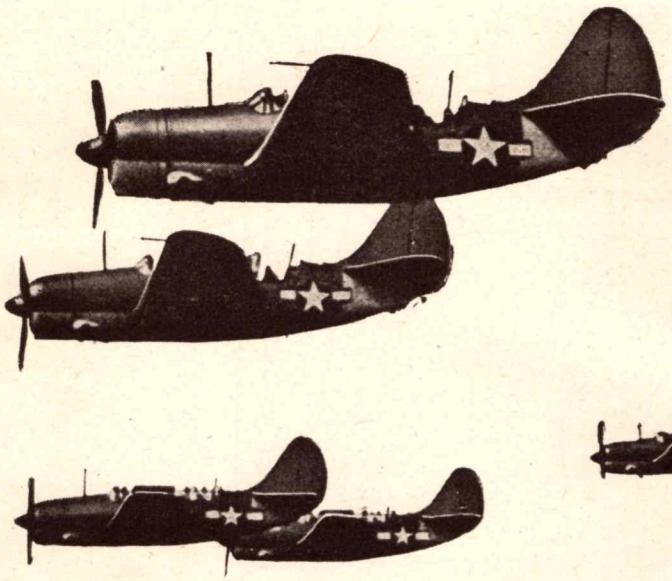
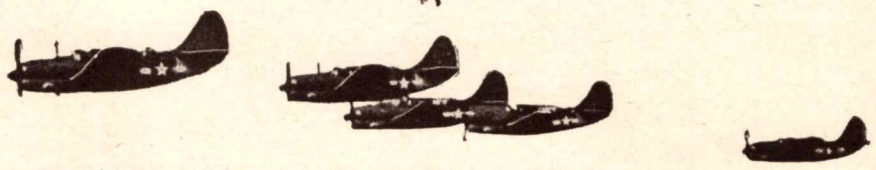


RICHARD E. SAUNDERS
Washington Editor

WASHINGTON In-formation



IN spite of all of the verbal broadsides that its top brass hats have unleashed at the unification proposal, the Navy is not going to win the battle—though it may appear to be having the upper hand for a while. It may, and probably will, come forth with a still more dazzling display of polemic fireworks—especially when the friendly Senate Naval Affairs Committee opens its hearings on the subject.

Chairman Walsh has promised to start these hearings as soon as the Senate Military Affairs Committee, before which the debate is now waging, is finished. But it is becoming clearer every day to those who know their Congressional meteorology that the weather is in for an abrupt change, and that when it comes it will dash completely the Navy's hopes of perpetuating the present dual command setup.

A fundamental change has occurred in Congressional thinking on the subject of national defense. It is not remarkable either that the legislative mind should be cognizant of what is going on and should strive to be in step with the times. Thus, the traditional concept that a strong Navy alone is the best peacetime protection against attacks by envious or designing countries is fading away. For years the argument made sense that the only way to preserve our national security was to build up a Navy second to none. Also it was pointed out with complete logic that a Navy only became a force that could command respect when it was a Navy "in being"—not merely a fleet in moth balls.

Senator's Grasp of Situation

As one of the Senate bellwethers who is always worth listening to recently put it: "Things are vastly different now with airpower playing a dominant role in warfare and very obviously slated to play a still more dominant one." Congress is beginning to perceive that the Navy can no longer lay undisputed claim to being the first line of defense. But along with the conviction that the bomber and fighter plane will have to be key items in plans for preserving the peace, the average Congressman is slowly grasping one other major fact. It is that the real reason why the Navy is so unalterably opposed to a merger is not that it is afraid that it would be unable to hold its own with an overall Secretary of National Defense, but because it does not want to have a separate air force established.

There is still another aspect of the situation. During past decades the Navy could point out that we were not hurting ourselves in maintaining a strong fleet, because in addition to obtaining security—which was and is admittedly cheap at any price—we were providing jobs in industry. The Army could advance no similar claim. Before the days of mechanized warfare, the building up of stocks of equipment for a large Army would only have had a trifling effect on business, even had we elected to take this preparedness step—which we did not.

With the coming of airpower, however, a different attitude is becoming apparent. The idea is percolating on Capitol Hill that the only way to be prepared in the air is to keep the equipment of our air force in constant rotation through the acquisition of improved models; and that civil aviation alone cannot begin to build up a proper volume of sustaining industry.

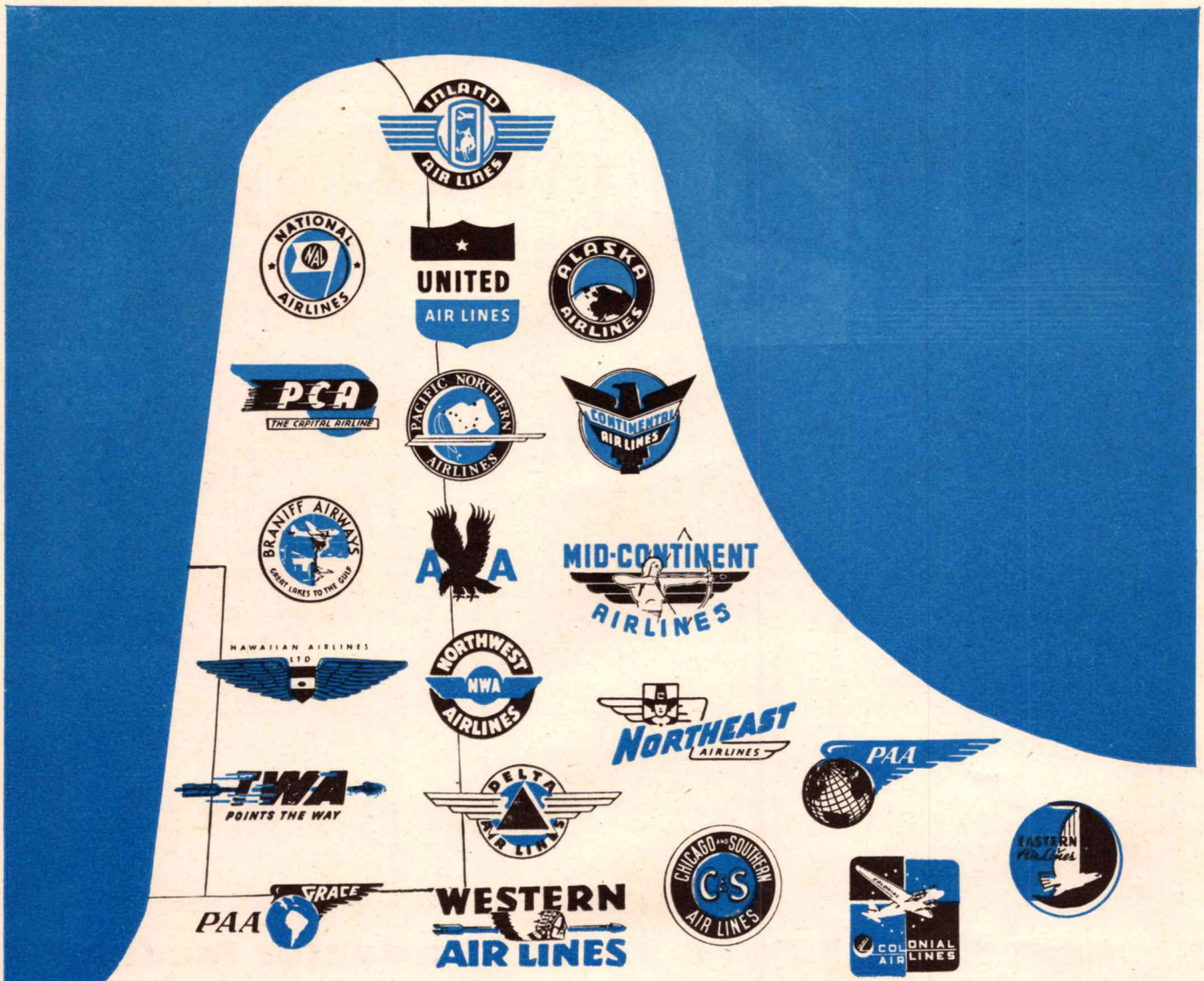
There is no apology needed for linking national security with the domestic economy. But where formerly the Navy had no rival in providing peacetime jobs, it now has one, and this fact is bound to weaken its position.

Meanwhile, Congress is on the verge of taking final action on a measure that will really knock the chocks from under commercial aviation—the Federal-aid airport bill. The jocular re-

(*Continued on page* 124)

Lt. Gen. James H. Doolittle and Mrs. Doolittle (center), in reviewing stand during homecoming celebration at Alameda, Calif.

Acme



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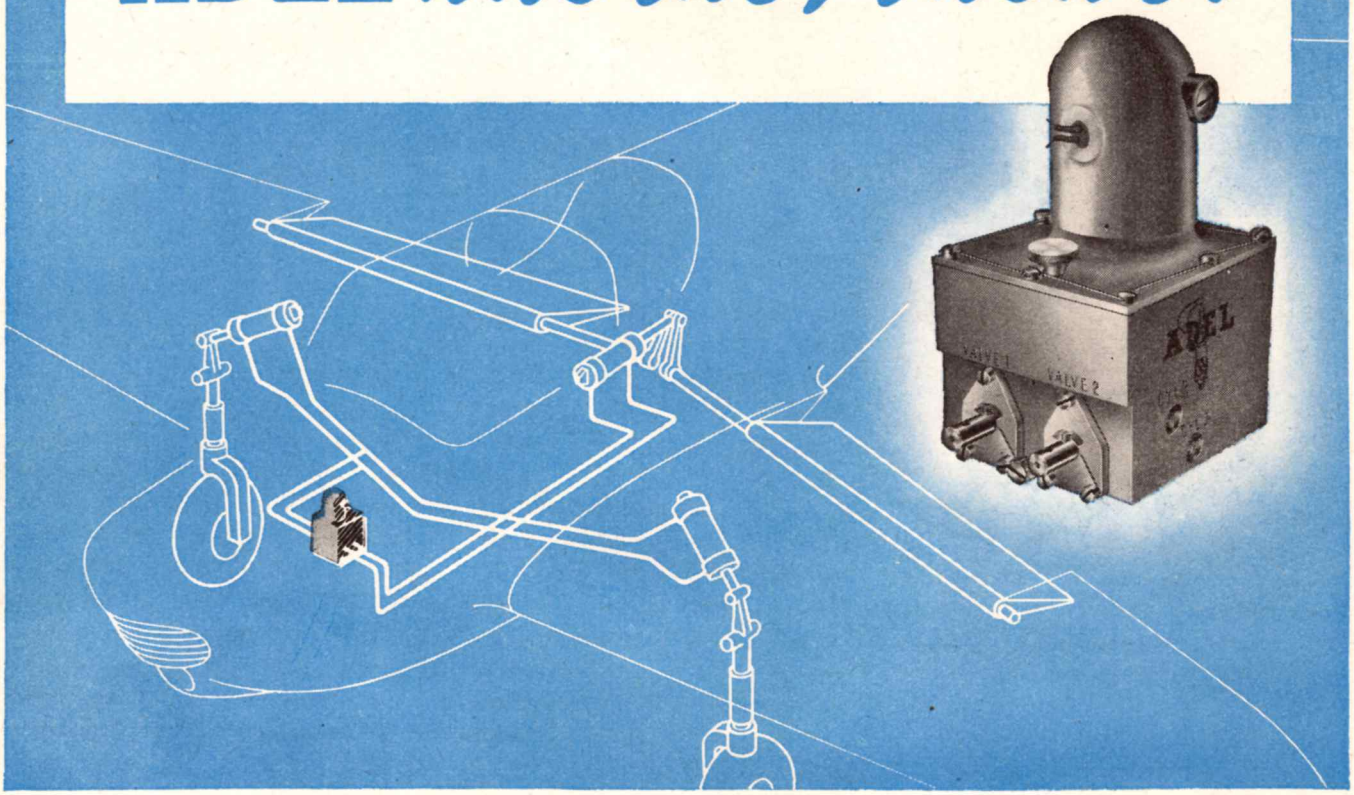

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EDITORIAL

NAVY!—WHY NOT?

IF the future of America's international air commerce is to be assured, every form of air transport must be developed to the maximum extent. The importance of aircraft to United States overseas commerce is as self-evident as our transcontinental railroad and express systems are to the success of our domestic industry.

If we are going to be able to meet the coming competition of other nations for world trade, we must keep the lead in all forms of transportation. This includes airships (lighter-than-air). The failure of the Navy to develop the American lighter-than-air project is deplorable. It was their project and theirs alone, and it is most difficult to understand why they should have shown such indifference and prejudice against this new and valuable addition to our air commerce and national defense.

The answer might be that money spent in this project would have taken away a few millions from the billions wasted on the useless and now obsolete battleships.

Just how the Navy has been able to nullify the recommendations of even its own (then) Secretary —Charles Edison—is best shown by quoting from a Special Report on lighter-than-air craft, prepared by Admiral Ernest King and Capt. Garland Fulton. Edison's comment follows: "These officers, pursuant to instructions, have submitted to me a report on the subject, and I am in agreement with their conclusions."

, , ,

THIS document, H. R. 8026—"To establish the composition of the United States Navy, to authorize the construction of certain naval vessels and for other purposes"—was sent to the Chairman on Naval Affairs, House of Representatives, in 1940, with a war spreading over Europe, which everyone, except those whose duty it was to keep informed and be prepared, knew would involve the United States.

"The Navy's responsibility in regard to lighter-than-air work is very much broader than the responsibility for doing what the Navy requires as regards its own airship needs. The Navy Department at the present time is the only governmental agency having to do with airships.

"Our helium resources, rigorously controlled as a military asset, are adequate to meet all prospective requirements. The costs of operating helium-filled airships, under proper conditions, need not be greater than the costs of operating with hydrogen. The possession of helium gives the United States an advantage with reference to airships, both military and commercial, that is not enjoyed by any other nation. The lack of helium has undoubtedly played its part as a deterrent to the continuation and development of lighter-than-air craft in other countries.

, , ,

"THE Department should maintain a broad-minded attitude toward improvements in airship construction, but at the same time it would be unwise—especially in view of the need to proceed promptly with further actual exploration and utilization of naval values—to delay immediate efforts by departing too far from that background of construction and performance which has been built up through the experiences of the last 30 years with airships which have given satisfactory performances.

"In this connection, it is remarked that less than a dozen rigid airships have been built in the whole world in the last 20 years—and only three of these were constructed in the United States. . . .

"In comparison with the expenditures and effort accorded airplane developments and facilities of all sorts, the outlay on airship developments is almost infinitesimally small—yet the return from this investment has been large. A good foundation has been laid on which further development for both military (Naval) and commercial airships can proceed. What has been demonstrated by foreign nations in the airship field can readily be duplicated by American ingenuity and effort, and can (*Continued on page* 81)

20 years & 20,000 ancestors make a great new plane engine

Twenty years ago airplane engines had a most unpleasant habit of stopping unexpectedly. The pilot looked for the nearest level field, and hoped! The repair crew came out with new parts if he made a safe landing; the ambulance and the junk truck came if he didn't. Risk of engine failure made flying a thrilling sport —but a poor way to make a living!

THE earliest Jacobs engines were planned and built to run longer, give less trouble, require less repair—and they did. So pilots who flew for a living became partial to the Jacobs. And every new Jacobs model was a little better.

Five years ago when the Empire Air Training Program was started in Canada, the British picked the Jacobs to power the twin-engine planes that schooled the bomber pilots. After Pearl Harbor, the USAAF followed suit. Most of our bomber pilots were taught their trade in planes powered by Jacobs.

Engines in training planes make more frequent take-offs, spend more time under full power than plane engines in any other type of operation. Student handling and bumpy landings subject engines to extra abuse. Yet these Jacobs engines stood up beyond all expectation. Specifications called for 350 air hours between major overhauls; and before the training program ended, the Jacobs was giving up to 1,200 hours—a record for stamina and minimum maintenance unsurpassed by any plane engine in military service.

Jacobs built more than 20,000 engines for the Armed Forces and our Allies. Production in quantity, constant research, and improved materials made possible the newest Jacobs, the R-755-A. It weighs the same as its predecessor, 505 lbs.—but develops 33% more power, and burns 8% less gas per hp hour. With a normal rating of 300 bhp at 2,200 rpm, the new Jacobs is the most efficient plane engine, without supercharger, in its power class today. Cruising at 75% power, it uses only 15 gals. of gas and 3 lbs. oil per hour—will fly more miles or greater loads at less expense; put more safety and security in regular flight.

For personal travel or family trips, for charter flights of passengers, for freight, for light transports and feeder lines—the Jacobs R-755-A will give more air hours, with less maintenance, and at lower cost than any other plane engine of its power rating. Watch for the new Jacobs—you'll see and hear a lot of it!

Jacobs Aircraft Engine Company, *a Division of Republic Industries, Inc.*

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AERO DIGEST'S

Aviation Engineering

OPERATIONS ISSUE

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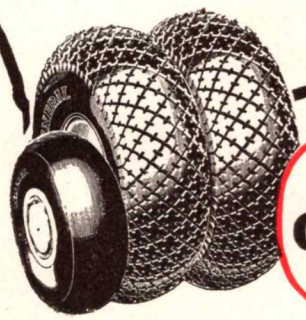
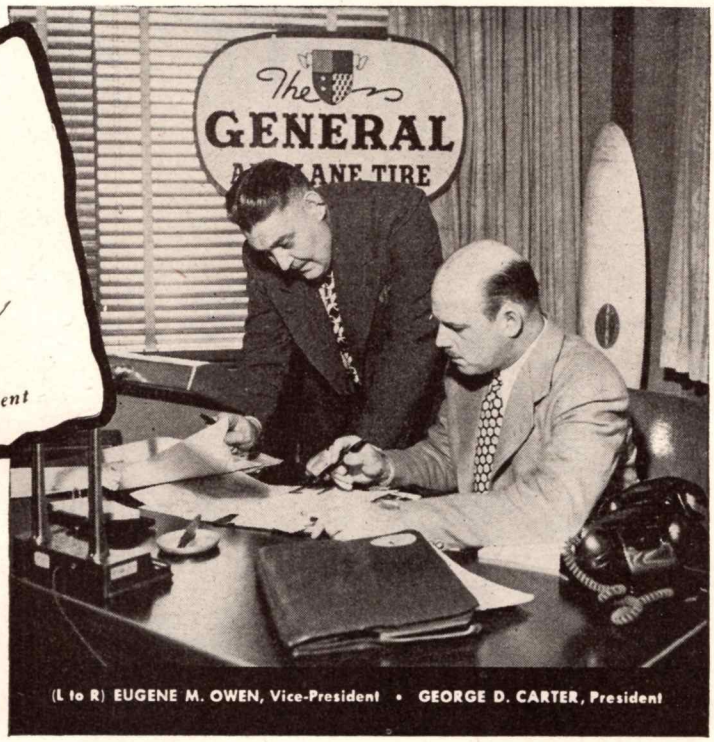


The GENERAL AIRPLANE TIRE



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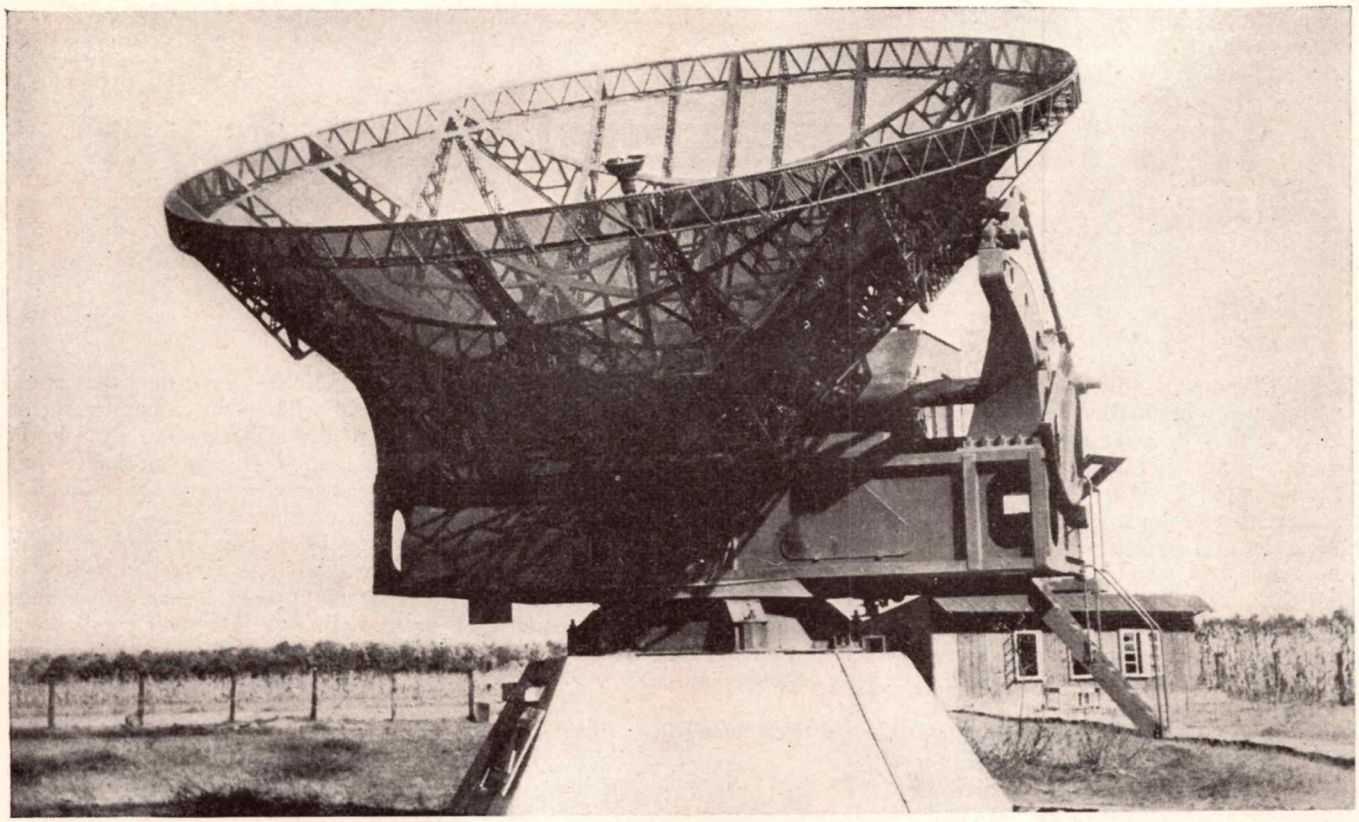


Antenna of a German "Wurzburg" installation used for around control of fighters, and for direction of anti-aircraft fire

Radar Countermeasure Techniques

FOR every weapon which is used by an enemy, a counter-weapon must be devised. This aspect of warfare was particularly emphasized in World War II when various types of radar devices provided armies, navies and air forces with "eyes" with which to detect an approaching attack, no matter how well hidden it might be by smoke, fog, or darkness.

In order to nullify the effectiveness of German radar, the Radio Research Laboratories of the National Defense Research Committee were charged with the task of developing anti-radar devices to be used by all branches of the armed forces. Shuttling between the Radar Countermeasures (RCM) laboratories in Cambridge, Mass., and the war zones in North Africa and Europe, scientists of RRL engaged in a battle of wits with German radar experts, and matched each new German defense technique with a highly potent and effective counter-weapon.

Of the radar countermeasures devised, two types were principally used. One was electronic jamming—broadcasting meaningless "noise" to confuse or drown out the signals received by the enemy's apparatus. The other, which presented distorted images on the scopes of the enemy's receiving sets, was produced by dropping quantities of metallic foil strips from an airplane flying within range of hostile watching, or search, apparatus.

These countermeasures take advantage of certain inherent characteristics of radar. Since a radar transmitter must send out a radio wave of considerable power in order that the weak return wave, or echo, may be audible, the direction and location of a transmitter can be determined by a properly equipped listening station. Further, because a radar's returning signal is comparatively weak, it is susceptible to jamming by broadcasting a "louder," or stronger, signal.

Confusing Reflections

Another characteristic of radar sets is that they cannot distinguish the nature of small targets. One small object looks about the same as another on a scope. It was found that a number of thin metallic strips, cut to a length proportional to the wave length used by a radar, can return a remarkably strong echo to the sending installation. In fact, several thousand of these thin metallic strips, packaged in a small bundle weighing less than two ounces, will, when dropped from a plane and allowed to fall freely through the air, give a radar echo signal equivalent to that from a large bomber.

The phenomenon here is one of resonance. The metallic strips, designated by the code name *Window*, are resonant at the frequency of the radio waves sent out by the radar. If a number of *Window* packets are dropped from a plane in succession, a trail is produced in which a radar can no longer distinguish its real target. The echo from the aircraft, appearing as a pip on the scope, is lost among the numerous echoes, or pips, registered by the *Window*.

In addition to *Window*, long ribbons of foil, called *Rope*, were also used. Like *Window*, they gave false echoes, so that a single plane could fill the enemy's radar scope with as many indications as would a squadron. Even if the enemy operator should rec-

(*Continued on page* 121)

Tips for the Personal Plane Buyer

WILLIS L. NYE

MANY persons still purchase lightplanes without the business acumen that they exercise when buying a new model automobile. Why does this situation prevail? The answer lies in the fact that it took nearly 30 years before the average customer for a new automobile had developed any idea of what he desired in performance or comfort. In many respects, the same situation prevails in the purchase of light airplanes by private pilots. In the past it was customary to pay high prices and receive little in performance or comfort. Such factors as maintenance costs, service cost, and probable depreciation or resale value were not considered.

A potential customer need not investigate engineering technicalities, aerodynamic characteristics, or a comparison of performance relative to competitors' products. The CAA guarantees these characteristics to be basically satisfactory to attain an Approved Type Certificate, without which widespread sale of the product would not be possible or legal. Issuance of the ATC guarantees that the airplane design has met and complied with the necessary requisites in accordance with the Civil Air Regulations.

Selection Factors

Lightplanes range in cost from $1.50 to $2.50 per lb. There are features other than price which are also determining factors in the initial selection. A general classification of the major requisites may be established as follows in their relative importance to the future owner:

1. Initial Cost, Maintenance, Service, and Depreciation
2. Comfort and Luxury
3. Technical Details and Structural Design

High performance has been considered to be of lesser importance. High performance can only be gained at a sacrifice of certain basic design features, all of which contribute to safe and economical flight. When only moderate engine hp is available, high performance of airplanes is not possible.

The relative merits of composite vs all-metal construction is of major importance in determining the initial price. Each type of construction has certain specific advantages. Total costs should be compared for each type on a basis of yearly depreciation and final resale value. A metal plane will have a higher initial cost. The attendant costs of financing any deferred payments, sales tax, insurance, and depreciation should all be considered on a proportionate basis.

Metal Repair Costs Higher

The cost of repairing a stressed skin fuselage will be higher than on other types of construction. Repairs in many instances can only be made by the manufacturer, or by an approved repair shop with special tools and equipment, and authorized to perform this kind of repair work. Major repairs to a stressed skin metal fuselage can only be performed by means of special jigs and tools.

If the structure is covered with fabric, the covering must be renewed at least once every two years if extensive flight operations have been made, and if the airplane has not always been sheltered in a hangar. Also, the character of the field from which flight operations are performed is a factor. Where mud, dirt and gravel are prevalent during taxiing, landing and engine warm-up operations, considerable wear of the fabric covering, especially on the bottom surface of the fuselage and on the surfaces of the empennage, will ensue. While covering and doping costs are inexpensive where limited damage occurs, complete covering, doping, and finishing are moderately expensive if they have to be performed frequently to maintain the airplane in an airworthy condition.

Composite structures may be economically and expeditiously repaired. Also, the cost of maintenance parts will be proportionately priced. But what of depreciation costs? In this respect, metal aircraft have a longer life, and will withstand exposure to weather and the wear caused by rough field flight operations to a greater degree. In either type of airplane, operating costs in flight are comparable. Thus, it may be established that metal airplanes will have a higher initial cost, but this will be offset by a lower depreciation cost and probably less maintenance cost over a reasonable duration of flight hours.

It is expected that each type of lightplane will have an air-cooled engine of comparable power, being either four or six cylinders in a dual opposed arrangement. Regardless of engine type, the engine compartment should be accessible for all minor servicing and adjustment operations, without it being necessary to consume extensive time to complete the inspection of accessories. Examine the cowling fastener. Does it require springs for proper functioning? Does it require a special screwdriver for attachment or removal? Certain kinds of spring fasteners tend to fail in service because of engine vibration. Those fasteners which require special driving tools are also inconvenient. Select a type of fastener which can be actuated by a standard screwdriver.

Note whether special tools are necessary to accomplish work on the powerplant. This is a factor in maintenance cost. Inspect the engine cowl panels for general over-all construction features, particularly for stiffening members or beads. Also note whether proper sealing materials are attached to the edge of the engine cowl panels. Examine the route of the incoming air to the engine carburetor and see if it is provided with a suitable means of heating. If a carburetor air heater is provided, the amount of heat supplied should be controllable from both seats in the cockpit, whether arranged side-by-side or tandem.

Engine Compartment

The most efficient firewall is one made from stainless steel, backed with a fireproof insulating material. Note whether the firewall tends to vibrate when the engine is being warmed. Vibration of the firewall may cause engine controls to creep if brackets attached to the firewall are part of the engine controls system. Where openings are necessary in the firewall, check for suitable fireproof grommets.

Engine exhaust manifolds are a source of frequent maintenance troubles. An engine exhaust manifold should be made of stainless steel or *Inconel.* This component should be quickly replaceable without the necessity of removing engine cylinders or other parts. For quiet operation and freedom from the ingress of engine exhaust gases into the cockpit, engine exhaust gases should be discharged through a single outlet.

In order to reduce intense vibration, it is customary to mount engines to the structure by means of rubber-bushed engine mounts, the rubber acting in shear and tending to dissipate the vibration. Investigate the service life of these components because they require periodic replacement and are moderately expensive to replace if this must be done frequently.

Where flexible connections are used, examine the material of which they are made. High quality flexible lines or hoses are made of *Neoprene* and have quick replacement fittings. Look for hoses having small radius bends because bends of this kind tend to cause failure in flight operations.

Safety in flight depends upon dependable magneto operation. In many installations, poor location of the magneto does not contribute to long service life. For example, the engine magneto should have ample ventilation in order to cool it in flight. Determine if ample room is available to remove or to replace the magneto, and if the breaker point clearance may be conveniently checked.

The engine oil tank must be removed during engine overhaul operations and any sludge accumulated in the interior must be removed. Because of frequent removal, the trunnion straps that hold the oil tank should be made of stainless steel. *Neoprene* pads attached to the trunnion straps should be used in lieu of impregnated felt. Felt tends to hold foreign materials, causing a source of dirt. Examine the location of the oil tank drain and be sure that the engine oil drains from the bottom of the engine compartment to an external container.

Fuel tanks should be placed in the safest position in relation to the engine exhaust manifold outlets. Investigate if the engine fuel tanks may be quickly removed or replaced without causing the removal of other components. The same kind of trunnion straps should be used to secure the fuel tank as are used to secure the engine oil tank. Similarly, check the outlet fittings and the drainage fittings on the engine fuel system and the fuel tank.

Fuel systems have been a source of much trouble and it would be wise to check the entire system from the fuel tank to the engine carburetor, and the various controls for the supply of fuel. Examine hose clamps and connections. Insist that *Neoprene* hoses be used where a break in the aluminum or copper fuel line is necessary. Note the position of the fuel tank vent line in relation to the cockpit. This vent should discharge any excess fuel to the air without the possibility of it entering the cockpit.

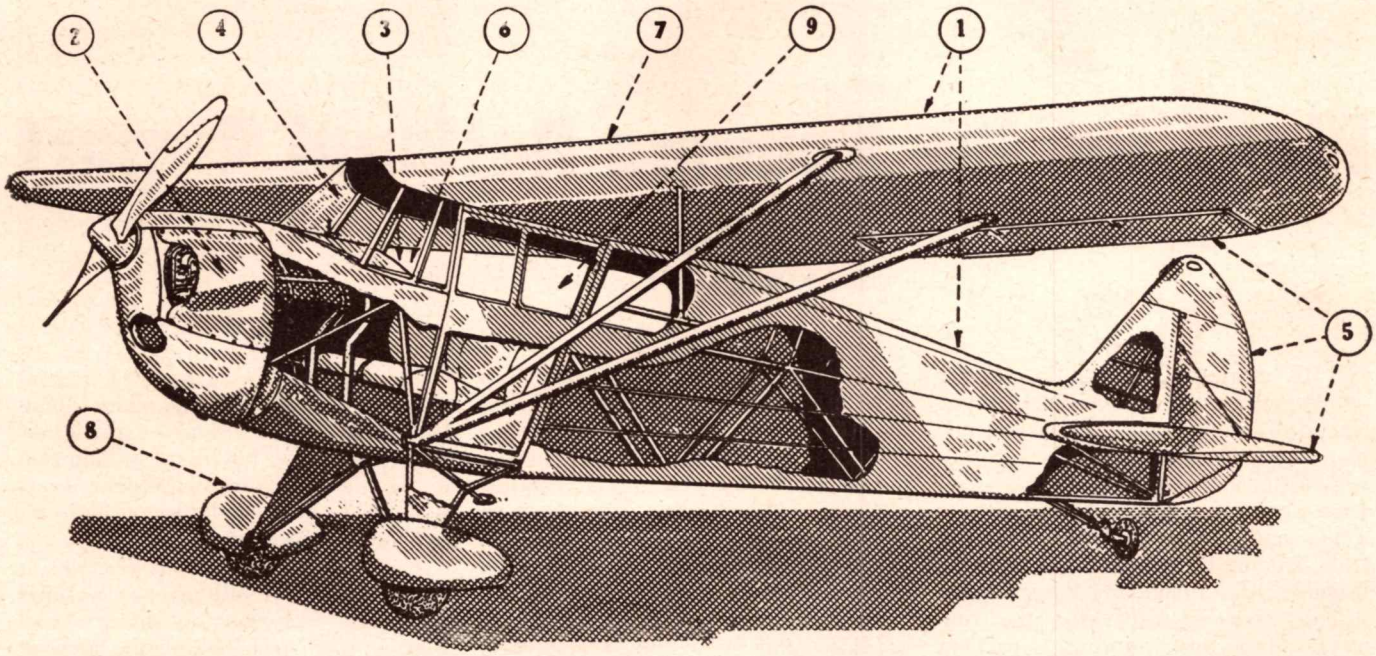
Fueling operations are a source of danger due to spillage of fuel which may become accidentally ignited. A safety measure frequently used is to provide a large diameter fuel tank filler neck. This allows the fuel hose to be inserted in the tank, and also allows sufficient area around the hose to permit the escape of air from inside the tank. For additional safety, make certain the filler neck cap is plainly marked "FUEL" and is not removable, except by disconnecting a chain attached to the tank. Next, consider the position of the fuel gage. The indicator should be visible from both seats during flight and on the ground.

Check the operation of engine controls. Sit in the cockpit and observe if all engine controls are operable from either seat. Raise the engine cowl panels and note if the push-pull tubes of the engine controls are adjustable as to length, and if the end fittings contain ball bearings sealed in a dust-proof clevis fitting. Also examine the ball-joint fittings and note whether means are provided to lubricate controls.

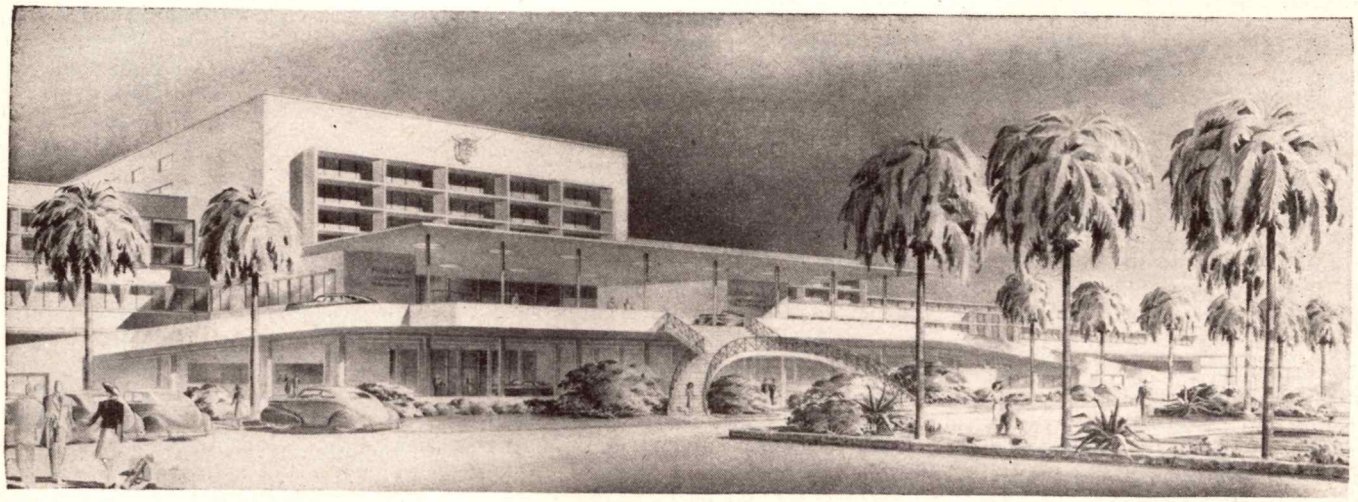
In order to check the operation of the controls, the prospective customer should sit in the cockpit and actuate the controls to the maximum and minimum settings during an engine warming operation. Note if the engine controls tend to creep at various throttle settings and if these controls have friction or adjustable stops to prevent a change in setting.

The initial cost of a lightplane depends to a degree upon the number of engine and flight instruments installed as standard equipment. In general, be certain that each instrument is the best of its respective type and that the airplane is equipped with an accurate

(*Continued on page* 128)



Features, characteristics and important assemblies to be checked when selecting a lightplane include: (1) Type of construction; (2) engine compartment; (3) instruments; (4) visibility; (5) control surfaces; (6) electrical system; (7) wings; (8) landing gear; (9) cockpit



Main entrance to proposed Panama National Airport administration building, showing passenger ramp to upper deck. The two-story reinforced concrete terminal building will contain approximately 300,000 sq ft of space

Plans for the Panama National Airport

C. B. HALL
Vice-President, F. H. McGraw & Company of Panama

THE projected, nine-million-dollar Panama National Airport is designed to accommodate the largest airplanes of the future and is laid out with an eye to expansion. More than 1500 acres of land lying between the Tapia and Tocumen Rivers, beyond Old Panama, have been allotted by the Republic of Panama for this purpose.

This area is ample for the runways, taxiways, aprons, parking spaces, repair and maintenance shops, and passenger and air express-freight facilities to accommodate all the planes and traffic now in prospect. Panama retained F. H. McGraw & Company of Panama for the engineering and architectural design of this airport.

The main airport terminal building, measuring approximately 213 ft deep by 597 ft long (excluding covered passenger walkways), will occupy some 63,360 sq ft on the ground floor level, encompass 60,500 sq ft on the first floor level, and 5885 sq ft on the upper floor level.

The building is of reinforced concrete and has been designed to minimize traffic congestion and facilitate the rapid handling of both incoming and outgoing passengers and their baggage. The various terminal functions have been arranged and coordinated so as to insure the maximum efficiency with a minimum of employed personnel

The principal functional feature of the plan is the separation of incoming and outgoing passengers and their baggage by placing all outgoing services on the first floor and all incoming functions on the ground floor. Furthermore, all motor traffic and loading activities will be kept on different levels outside the building. Thus, the delays usually occasioned by converging or conflicting traffic will be eliminated.

Public observation facilities will be provided and so arranged as not to interfere with normal passenger traffic. Spacious concession areas, including shops, lunchroom, bar and restaurant, have been designed and located to provide the maximum of attractions. The first floor (main floor) of the terminal building, in addition to housing outgoing passenger functions, will also include the public services and conveniences.

TABLE 1
Spaces to Be Air Conditioned

Space	Air Capacity cfm
Ground Floor	
Lunchroom	6000
Passenger lounges, left wing	8000
Customs work space, left wing	8000
Waiting room	6000
Operations room	8000
Customs work space, right wing	8000
Passenger lounges, right wing	8000
Post office section	8000
Main Floor	
Dining room	10,000
Bar and lunchroom	8000
Ticket offices, hall and offices, left wing	10,000
Central hall	8000
Hall below control tower	10,000
Ticket offices, hall and offices, right wing	10,000
President's office	3000
Rooms in right wing, individual units for each room	440 each

The main lobby, 79 ft by 180 ft by 31 ft high, will have a two-level passengers' observation lounge and waiting room overlooking the airport, with a seating capacity of 200. Daylight will be provided at the front and rear by large glassed areas, protected from direct solar light and heat by elongated mullions and overhangs. Ornamental stairs on either side of the passengers' lounge will lead to an elevated inside-and-outside public observation mezzanine overlooking the entire landing field and parking apron.

Two public concourses, each 52 ft by 98 ft, will lead out from either side of the main lobby. On the field side of the concourses, there will be six modern airline offices and ticket counters complete with flush baggage scales located at intervals in the counters and ample enclosed office space. Provision has been made for future ticket office expansion, should the present six offices prove inadequate.

Concession areas, with a total length of 197 ft, will be located on the opposite side of the concourse from the ticket offices. These concessions will be entered and serviced by private stairs leading from outside the building to

a public corridor in their rear. The upper floor of the terminal building will be devoted exclusively to the technical functions of airport operation.

Directly under the glass-enclosed control tower will be the operations and traffic control room; the central radio communications sending and receiving rooms with space for each airline; flight watch rooms for six airlines (with provision for additional rooms) adjoining the central operations and communications area; and a meteorology room, with access to the outer terrace for release of weather balloons, will adjoin the communications room.

The airport manager's office will be on this floor, and in addition to the stairs an elevator will connect with the lower floors. The airport beacon, with direction and velocity instruments, etc., will be directly above the glass-enclosed control tower.

Facilities have been provided for the accommodation of ten DC-3's or eight *Constellations* or six DC-7's. The two cross runways, one a mile and a half long by 200 ft wide, and the other a mile by 200 ft, can be duplicated if increased traffic requires by building similar runways along the present ones.

This provision for expansion is particularly significant in view of the North America-South America routes to Europe, via Africa.

While the Panama National Airport will be presently the largest air terminal south of the United States, no doubt other comparable airfields will be built farther south, especially in Brazil where the Rio de Janeiro airports have been carrying the major loads of passenger and air express-freight traffic and which today are inadequate to accommodate international flight requirements.

The Airport Hangar

The airport hangar will combine the functional and economic advantages of the nose hangar principle, i.e., it will provide for the complete housing of large type aircraft with the exception of the tail assemblies. The hangar building floor will be approximately 104 ft by 230 ft and the servicing and housing of planes will be possible from both sides. One side will be contiguous to the freight loading apron and the other to the repair apron.

From a center section, enclosed by the roof supports and constituting the minor repair-work area, the roof structure will consist of a two-way cantilever extending outward from the supporting columns approximately 39 ft on both sides. The clear height from the floor to the underside of the cantilever will be 33 ft, which will accommodate any type airplane up to 6½ ft higher than a DC-7.

The floor area will provide for the housing (excluding tail assemblies) of any of the following combinations of aircraft: four DC-3's; four B-307's; two DC-4's; two *Constellations*; two DC-6's or 7's; two DC-3's; one DC-4, 6, or 7, or *Constellation;* two B-307's and one DC-4, 6 or 7, or *Constellation.*

The two entrance openings to the hangar will be closed and sealed by counterbalanced, overhead doors arranged to accommodate any of the above planes, or others of similar size. The doors, electrically-operated, will close in 30 sec. Chain hoists on two-way adjustable overhead track cranes will aid in rapid propeller and engine removal. Supplementary doors, within the area of the larger doors, will allow the tail assemblies of planes within the hangar to protrude beyond the building and, at the same time, permit complete enclosure of the hangar area.

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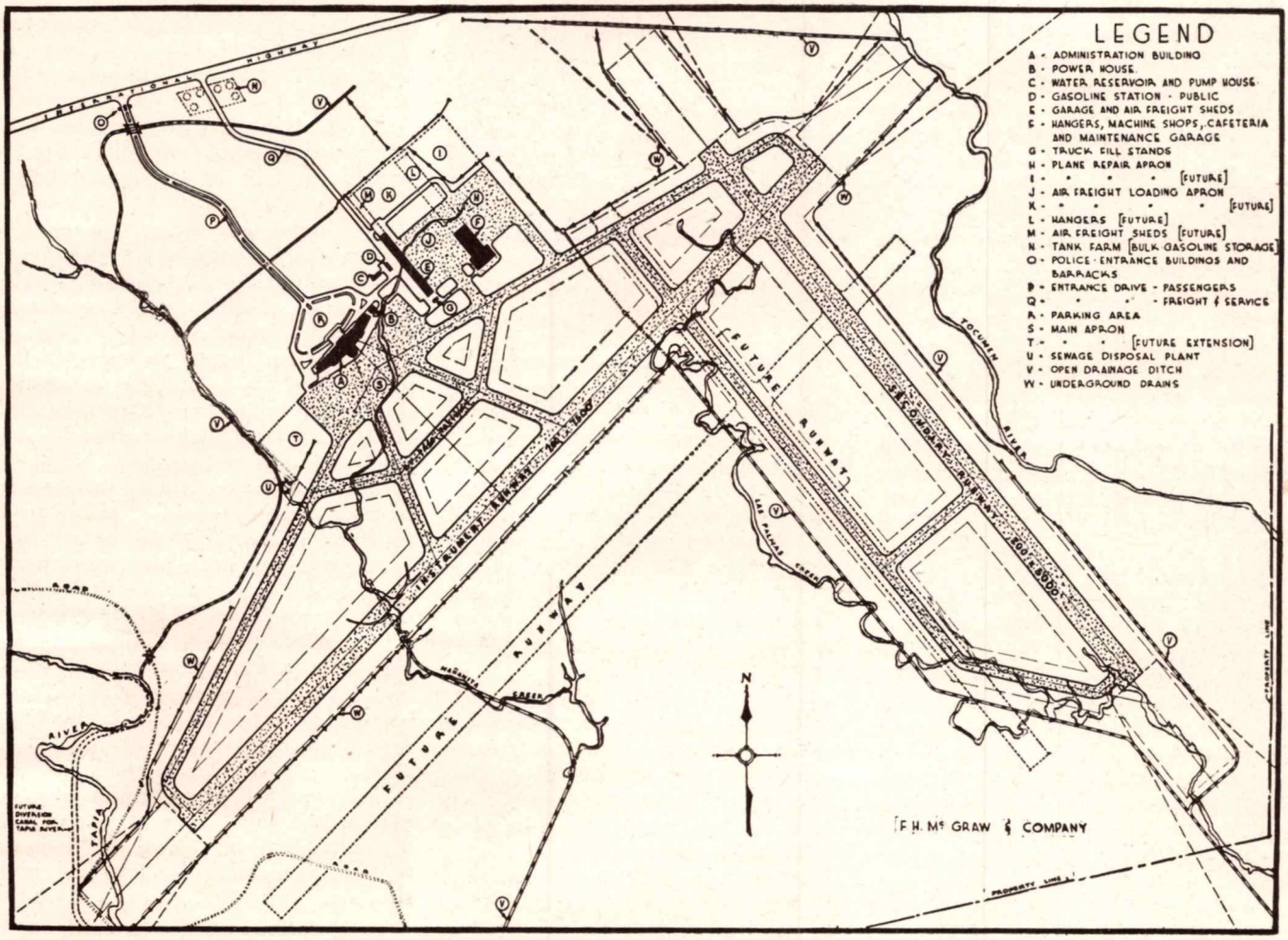
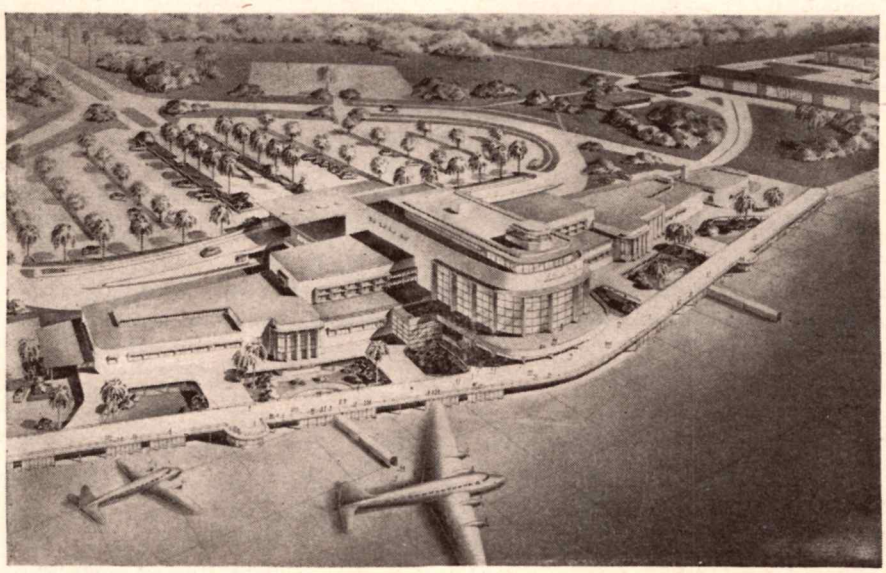
Plan view of Panama's airport on which some seven million dollars will be expended and which will cover 1500 acres


LEGEND
A - ADMINISTRATION BUILDING
B - POWER HOUSE
C - WATER RESERVOIR AND PUMP HOUSE
D - GASOLINE STATION - PUBLIC
E - GARAGE AND AIR FREIGHT SHEDS
F - HANGERS, MACHINE SHOPS, CAFETERIA AND MAINTENANCE GARAGE
G - TRUCK FILL STANDS
H - PLANE REPAIR APRON
I - • • • [FUTURE]
J - AIR FREIGHT LOADING APRON
K - • • • • [FUTURE]
L - HANGERS [FUTURE]
M - AIR FREIGHT SHEDS [FUTURE]
N - TANK FARM [BULK GASOLINE STORAGE]
O - POLICE - ENTRANCE BUILDINGS AND BARRACKS
P - ENTRANCE DRIVE - PASSENGERS
Q - • • - FREIGHT & SERVICE
R - PARKING AREA
S - MAIN APRON
T - • • [FUTURE EXTENSION]
U - SEWAGE DISPOSAL PLANT
V - OPEN DRAINAGE DITCH
W - UNDERGROUND DRAINS
INTERNATIONAL HIGHWAY
TOCUMEN RIVER
RIVER
FUTURE RUNWAY
FUTURE
N
F. H. Mc GRAW & COMPANY

(*Continued from preceding page*)

Adjoining the south end of the hangar will be four machine-shop areas, each 44 ft sq, ample for the necessary repair machinery. Other repair-work space will be provided on an upper platform level located between the center supporting columns.

To the north of the hangar and between the freight and repair aprons, a spare parts storage building, covering approximately 41,580 sq ft, will be divided into six separate 6930 sq-ft areas. Each area will be enclosed with fireproof walls, with self-closing fireproof doors and will contain a receiving and checking office. The floors and covered receiving platforms will be ½ ft above the apron, and the platforms will have curb ramps to allow truck passage in and out of each section. The clear height will be 13 ft.



Aerial view of the administration building from the airfield side. Oval parking area will accommodate 500 automobiles

The warehouse entrances will be closed by fireproof, counterbalanced, manually-operated, overhead doors. These buildings will be so situated that they may be extended to the north if necessary.

A row of four fireproof air-freight warehouses, each 118 ft by 59 ft, will extend along the westerly edge of the air-freight aporn. Receiving and checking offices and customs-inspection offices will be located in every second section. The floor and loading platforms will be ½ ft above the apron, and the entrance doors (similar to those in the parts-storage sheds) will be so distributed that trucks can drive from the service road through the different areas and out upon the loading apron. Additional units may be added to the north, as required.

An area near the main highway will be reserved for the erection (by one or more oil companies) for bulk aviation gasoline storage. From the storage tanks, an 8-in main, for each company, and for each type of gasoline, will run to a concrete trench extending along the edge of the main parking apron, adjacent to the covered passenger walkways. At intervals along the apron, branch lines will run from the trench to hydrants at the plane parking positions. Planes will be refueled from the hydrants by jeeps equipped with pumps, motors, hose, and supplies of oils. Electric outlets will be placed at each hydrant location.

Turntables for locked-wheel turns will be provided for the planes at the parking positions. A complete gasoline service station will be available at a central location for refueling private cars and airline automotive equipment. Three double truckfill stands at the south end of the freight terminal building, adjacent to all three aprons, will be used by supplementary gasoline trucks for refueling planes located on the freight and repair aprons.

Two entrance drives will connect the terminal building with the main highway. The main entrance drive will be reserved for airline busses and passenger cars.

The service entrance and exit drive will handle all trucking for freight, airmail, supplies, laundry, fuel deliveries, etc.

The main entrance boulevard will consist of an entrance and exit drive, each 24½ ft wide, separated by a landscaped strip. The entrance drive will divide into two lanes at a point near the terminal building, one leading to the lower level of the building, and the other to the upper level. A third lane will lead to the local airline office.

The main two-way service drive, 24½ ft wide, will extend past the gasoline bulk storage area to the freight sheds and service wing of the terminal building. Cross access to all areas will be achieved by connecting drives, designed to obviate traffic congestion or confusion.

In front of the terminal building, between the incoming and outgoing lanes of the main drive, will be a private parking area for 500 cars. Taxi parking areas will be provided near the local terminal. Cabs will be called by electric signal by the taxi starter booth from these retention areas to the terminal exits, as required.

Walks will connect all parking areas with both levels of the terminal building. All walks and drives will be surrounded by planted areas to provide a tropical setting for the main building by means of large planted areas between the main structure and the covered-passenger walkways leading to the loading gates.

Source of Electricity

Electricity will be supplied by three Diesel engines connected to three 3-phase, 3-wire 2300 volt, 60-cycle alternators of 250 kw each. This current will be stepped down by transformers to 120-208 volts where used. Fluorescent lighting will be employed throughout the various buildings. If required, floodlighting will be installed at the ends of each runway. The aprons in front of the terminal building and at the utility buildings will be illuminated with a series of 500-watt floodlights.

Both a rotating beacon and a flash beacon will be installed, contact lights along runways, taxi lights along the aprons and taxiways, green approach lights at the runways.

Obstruction lights throughout the airport area will provide maximum protection. Ceiling projector and clinometer, wind tee and other incidental equipment will be provided.

The complete control of the airport lighting will be located in the control tower of the terminal building.

A certain amount of the water heated by the Diesels will be utilized in the hangar washrooms and lunchroom. The remainder will be cooled by spray fountains in a pool directly in front of the terminal building. These fountains will form a feature of the approach drive and will be illuminated at night by ground level floodlights.

Buildings will be of reinforced concrete with frames of the skeleton type. The exception to this is the hangar roof which will be of corrugated steel sheeting. Windows, doors and orna-

(*Continued on page* 122)

All-Steel Hangars for Lightplanes

● In line with the trend to lower the cost of personal flying to increase the utility of the lightplane, Universal Corp. revived a time-honored airport custom and designed an individual airplane shelter from a different approach.

In large hangars, when winds reach velocities high enough to make opening of large doors a hazard, it has been customary to open them only as wide as the fuselage is long. The airplane is then maneuvered through the doors by bringing the fuselage abreast of the opening, with one wing projecting into the interior. By picking up the tail and swinging it into the hangar, the plane is automatically positioned inside, through an opening considerably smaller than the full wing span of the airplane.

Utilizing this idea, Universal has reduced construction costs on steel, all-weather hangars, with weatherproof doors. This was accomplished by eliminating the heavy, 40-ft trusses required in the conventional "T" hangar with an open 40-ft front. Not only do the trusses have to sustain the weight of the building, but also door and snow loads.

Door Width Reduced

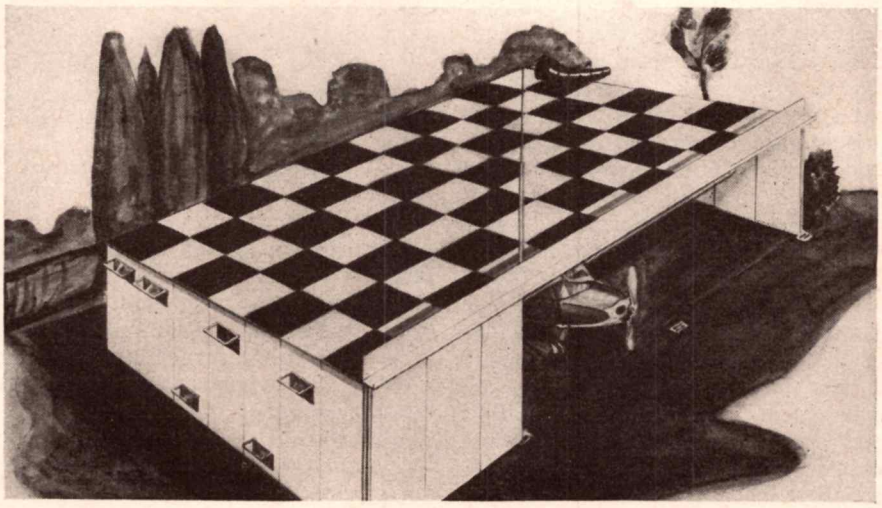
Under the Universal plan, it is possible to reduce the width of the door 10 to 12 ft and to use a supporting column, placed in the usual free span, for the purpose of cantilever truss construction, which in no case requires a truss over 20 ft in length. A unique diamond truss design in the roof stresses the structure amply for both snow and wind loads—at the same time lightening the steel required, yet retaining a sturdy structure.

The doors, a high cost factor in any hangar, have been cut down to two 14-ft sections which do not require extension tracks when open. They are of tight construction for protection against wind, rain and snow. Special mechanical fasteners make it possible for unskilled workers to erect the complete structure without previous experience. Concrete piers are poured and bolted to the frame after it has been erected, eliminating another possible high cost item.

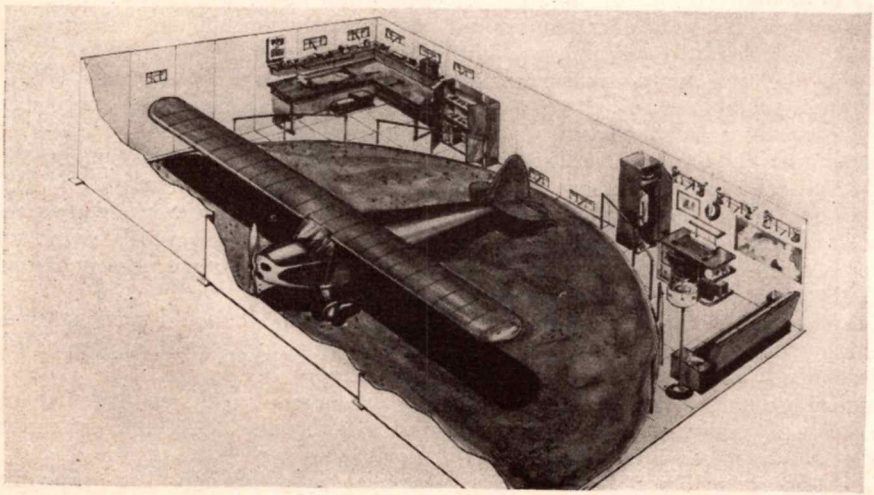
The roof and siding are made of corrugated steel, factory-painted with red lead, affording the owner the opportunity to paint the structure in any color desired. Galvanized metal being difficult to see from the air, the thought is advanced that vari-colored paint schemes would make an airport easily discernible from the air, and there is also the possibility of adding to the attractiveness of the airport surroundings.

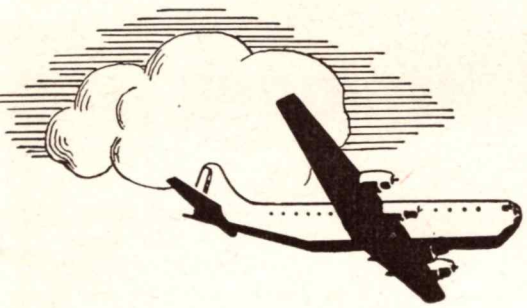
The Universal Corp., Dallas, Texas, fabricated and delivered thousands of nose shelters for all types of Army and Navy aircraft during the War and is now utilizing this experience in fabricating hangars for the personal plane. The first hangars will be sold through jobbers, and if found to be practical, this plan will be continued in the future.

View showing doors fully open (approximately 2/3 of hangar width) with no extending tracks required. Front of hangar receives additional support. Plane is hangared by bringing fuselage parallel to opening and then moving it into place by swinging tail into the interior



Sketch depicting a possible arrangement of the hangar interior for a sales agency. Ample room is provided for customer reception, plane display and office needs. Provision is made for adequate ventilation and lighting. When desired, a plane can be quickly rolled outside for a demonstration





Utility and Comfort Merge in Boeing "Stratocruiser"

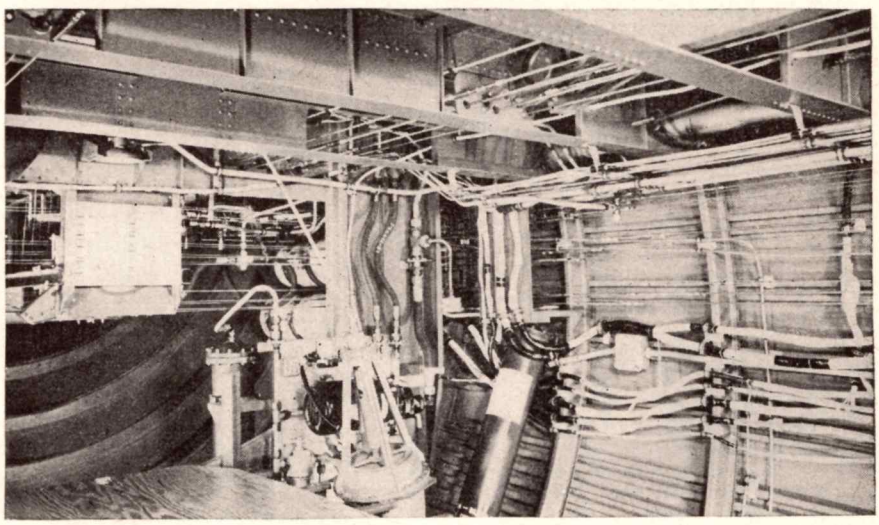
BOEING'S 130,000-lb (specification takeoff weight) Model 377 *Stratocruiser* is a double-deck, 4-engined airplane of semi-monocoque construction, capable of carrying a maximum of 114 passengers or a cargo load of 39,000 lb. In effect, the plane's upper deck rides pickaback on a *Superfortress* fuselage. Like its C-97 prototype, it is an extended development of the B-29, using similar landing gear, wing, tail, and control surfaces, and possessing the same aerodynamic cleanness.

The two-deck arrangement offers advantages not generally available in transport aircraft. One feature is man-height cargo holds separated from the passenger sections to make loading faster and easier. In all *Stratocruiser* configurations, except the all-cargo model, passengers are carried on the main deck and have access by a circular stairway to a 14-passenger lounge below, in which facilities are provided for serving snacks and drinks.

The galley is located aft of the main cabin for maximum convenience in serving passengers. Men's and women's lounges are located forward in the main cabin. Two cargo holds, with a total usable space of 900 cu ft, are located fore and aft of the center wing section. Each cargo hold has a truck bed-height drop door into which steps are built. The loading facilities of the airplane as a whole are arranged to allow simultaneous transferal of passengers, cargo and baggage, and terminal servicing, with the specific purpose of reducing ground time to a minimum.

More Comfort and Greater Safety

More complete passenger comfort has been attained by the greater fuselage volume in passenger compartments (more space per passenger), greater freedom of movement (lounges), the tendency of high wing loading and high speed to smooth out air bumps, low cabin altitude conditions, even when traveling at high altitudes, the



Large, open area directly below the control cabin permits rapid inspection and servicing of control cables, electrical wiring and accessories

Stratocruiser's ability to ascend and descend (in terms of cabin altitude conditions) at low, uniform rates, independent of the airplane's flight pattern, and pleasing furnishing and other interior accommodations, such as soundproofing.

The plane's safety features include its unusual ease of control, exceptional ruggedness, flight stability, simplicity of systems, anti-icing system, wide range of pilot vision, over-weather operation at high altitudes and speed which enables it to complete flights within the time limit of the more accurate weather forecasts.

Outstanding advancements in the plane are: (1) altitude-conditioning of the entire fuselage from sea level; (2) dual set of nacelle-installed auxiliary powerplants, serving the electrical needs of the whole plane; (3) ability of the automatic air-conditioning system (heating, cooling, quality control, altitude conditioning) to function independently of the main powerplant or ground sources; (4) steerable nose wheel; (5) central control stand for pilot and co-pilot with common engine, trim tab and other controls; (6) extended facilities for freedom of passenger movement; (7) one cent a passenger-mile or five cents a cargo ton-mile direct operating costs; (8) utility as a fast (340-mph) carrier for short-range, medium-range or long-range use, either for the ultimate in day or night luxury travel, high density "commuter" travel, combined passenger and cargo hauling, or all-cargo use, at altitudes from sea level to 30,000 ft.

Of the many variations possible in the arrangement of the *Stratocruiser* interior, five major ones are:

1. Standard: 67 passengers, 900 cu ft cargo (81 passengers if lounge seats are sold).

2. Commuter: 114 passengers, 900 cu ft for baggage and cargo.

3. Berthable: 65 day passengers and 900 cu ft cargo space, or 30 berths and one seat (14 additional seats in lounge, day or night).

4. Half and half: 71 passengers on upper deck, 1400 cu ft in lower deck for cargo.

5. All-cargo: 5720 cu ft for cargo, using both decks (39,000 lb maximum payload).

Use of the Boeing "117" high lift-

Short range loading (up to 500 miles) with 120,000 lb takeoff gross weight, 850 gal fuel reserve

Medium range loading (2500 miles) with the takeoff gross weight at 130,000 lb

Long range (4200 miles) fuel-payload comparison. Takeoff gross weight is 140,000 lb

drag ratio airfoil permits carrying larger loads at higher speeds. Thus, while the *Stratocruiser's* over-all dimensions are only slightly larger than those of comparable transports, its ability to carry a greater pay load farther, faster and at lower cost is noteworthy. Useful load is 43% of gross weight, as compared with 33% of the gross weight on many present transports.

Direct flying costs, per 200-lb pay load unit, remain under the one cent per mile mark at ranges from 300 to 2300 miles. The unit cost at 300 miles is one cent. The figure drops gradually to 0.6 cent at 1500 miles, then rises again gradually to 1.5 cents at 3050 miles with normal fuel capacity or at 4050 miles if external tanks have been added. The 340-mph maximum cruising speed is nearly twice the 185 mph of present transports. The plane also has the ability to carry a pay load of 19,200 lb a distance of 2500 miles at 130,000 lb takeoff weight.

High Time Utilization

The Boeing Company states that direct operating costs can be met with this airplane, at present airline rates, even if less than 20% of total passenger and cargo capacity is utilized.

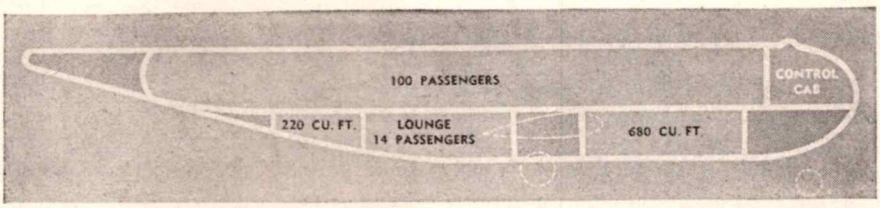
Greater speeds and high utilization present greater advantages to the operator than to the average customer. The passenger, unless he is a steady business traveler or on an emergency trip, may not always consider important the time saved between a trip at 185 mph and one at 340 mph. But to the operator, faster schedules will mean more mileage covered in a 24-hr period by the same equipment. The greater use to which the airplane may be put, the thinner will be the spread of depreciation and other fixed costs and more productive use can be made of ground crews. Trips of shorter duration also will result in operator savings in the expense of passenger services, such as meals.

Savings obtained through increased efficiency in the air can easily be swallowed up through time lost at terminal or intermediate points. This fact was a main consideration in designing the *Stratocruiser*, for it provides an efficient system for the interchange of passengers and cargo, neither interfering with the other.

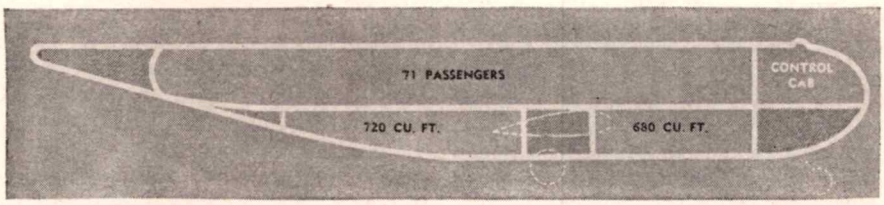
In the high density versions, as a timesaving factor, passengers may enter and leave the figure 8 fuselage either through the upper deck door or through another door just aft of the lower deck lounge. Built-in steps in the lower door provide a means of entrance and exit without the use of ground equipment. This is a definite advantage, particularly at intermediate stops.

Stratocruiser facilities for baggage and cargo handling may establish new

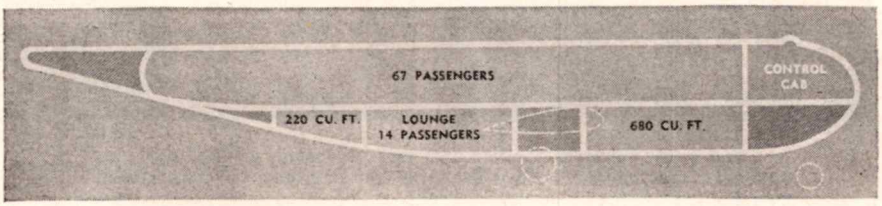
(*Continued on page* 111)



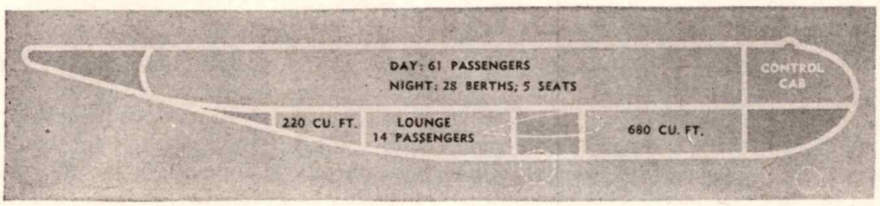
"Commuter" arrangement: 114 passengers; 900 cu ft for baggage and cargo



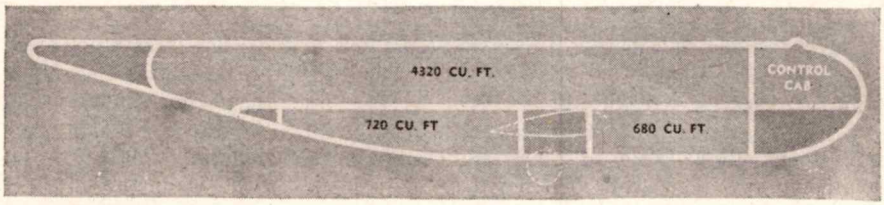
Half and half: 71 passengers on upper deck; 1400 cu ft of cargo space below



Standard arrangement: 81 passengers, including lounge seats, and 900 cu ft of cargo space



Berthable 75 day passengers or 28 berths and 19 seats. 900 cu ft cargo capacity

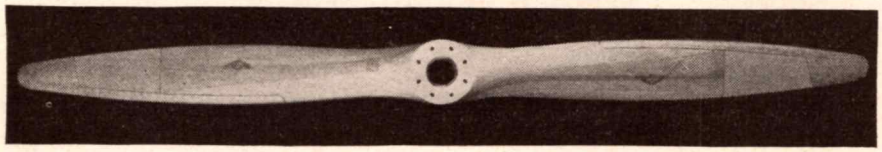


All-cargo: 5720 cu ft available for cargo on both decks; 39,000 lb maximum payload

Propeller Care Rewarded by Long Service Life

The rapid increase in personal flying makes it imperative to stress the important phase of maintenance on lightplanes. In this connection, many pilots do not realize how much wear and tear is normally inflicted upon the propeller.

Propeller parts can be likened to other parts of the airplane in that small defects become larger and more serious unless corrected immediately. The air through which a propeller whirls is not always clean and pure. Loose gravel and cinders from parking areas and taxi strips or runways provide bits of abrasive material which cause nicks and dents when struck by the blades at high speeds. It is sound policy to avoid operating engines at high speeds in such areas. The plane should be on solid turf or a paved surface before running up the engine.



Fixed pitch wooden propeller, used most commonly on lightplanes. It is important to keep blade tips and surfaces in good condition. Bolt holes in boss should be watched for elongation

Weeds and high grass will take their toll, especially on blade tips. Even rain can have an effect similar to that of sandpaper. Operation of an aircraft in a rainstorm may result in the varnish being stripped off wood propellers. In such cases, an immediate inspection is necessary to determine the extent of damage. It may be necessary to refinish the entire propeller. In this event, the propeller must be re-balanced. A change in weight as slight as a varnish job can throw the blades out of balance.

Daily visual inspection will uncover any small flaws before extensive damage begins. Reworking of nicks and dents should not be postponed beyond a reasonable time. In addition to checking for dents, deep scratches and split sections in wood blades, the thin blade tips require constant watching to guard against checking and splitting. Metal sheathing and other covering must be inspected for proper fastening and surface condition.

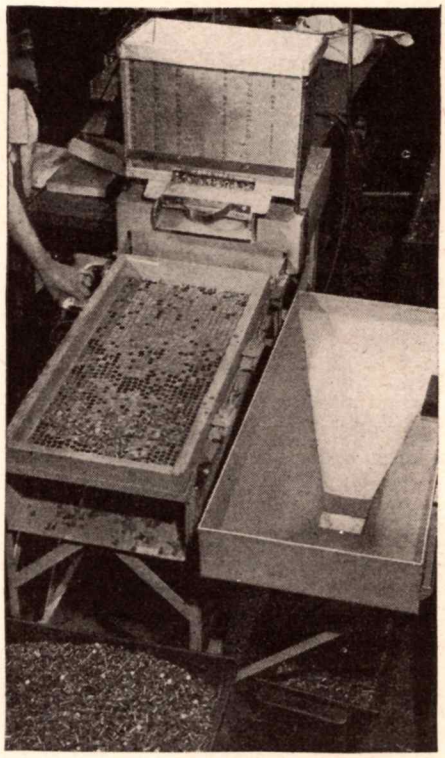
Hub bolts are examined for tightness and adequate safeties on the nuts. Elongated holes in the boss prevent secure tightening and constitute a dangerous operating condition which should immediately be corrected by a replacement. The most important check point is the propeller retaining nut on the crankshaft. This calls for at least a daily inspection to be certain that the hub remains secure on the engine shaft and that the retaining nut is properly safetied.

Excessive heat is another enemy of long propeller life. Wood propellers will crack and laminations may separate if stored too close to radiators or other sources of heat. Excessive moisture is equally bad. Keeping the propeller in a horizontal position is good practice.

Metal propellers are not in widespread use on lightplanes at present. However, maintenance is equally important and repairs usually require a higher degree of skill. Metal blades will provide a longer service life, but the initial cost is considerably greater.

Countersunk Rivets Sorted by Head Sizes

Due to the use of countersunk rivets having 100° heads, a different type of rivet sorting machine became necessary at The Glenn L. Martin Co. The majority of rivets being used prior to this time were of the 115° head type. Sorting machines already in operation would not separate the 100° rivets from the 115° rivets.



Metal sheet, punched full of holes of accurate diam and oscillated by a motor, separates 100° and 115° countersunk rivets

Sorting operations could be carried on to a point where these two types reached the same boxes, but from there on they had to be hand-sorted. Many hr were spent in hand sorting, the amount of work turned out was small, and even more disturbing was the fact that the most careful workers were unable to make a perfect segregation. The possibility of improper types of rivets reaching the assembly line was too great.

Made entirely of scrap metal, a machine was devised with an inclined screen oscillating 140 times per min. The separating screen is made from a piece of sheet steel, punched full of holes of a certain diam. In operation, the 100° rivet heads being a few thousandths of an in smaller, pass through the screen, while the 115° rivets remain on top of the screen, even though of the same shank diam. By pulling two pins, the screen can be removed and replaced with a screen having holes of a different diam to provide for sorting of other items, such as nuts, washers and screws.

The frame for the sorter was made from scrap angle iron, the screens from scrap wood and sheet steel into which holes have been punched with a punch press. Handles were fashioned from salvaged clamps, the feed chute and hopper from aluminum and the auxiliary chute from galvanized iron. Power is supplied by a small hand motor.

Maintaining Electric Motors and Controls

Each year, thousands of "sick" electric motors are brought to repair shops all over the country for maintenance service and repair after they have failed during normal operation. According to Westinghouse Electric, after analyzing records of numerous repair cases, there are four main causes of motor failure.

The greatest single enemy of motors is dirt. Dirt can plug ventilating spaces and interfere with cooling. It can glaze the faces of commutator brushes, resulting in harmful sparking. Dirt can abrade sliprings, multiplying wear and blocking the passage of full current.

These conditions do not occur if periodic, sensible precautions are taken. Enclosed motors need only to be checked with a wrench to keep exposed joints tightened. Open types require additional precautions, especially to keep dust out of bearings, and checking to see that dust seals and gaskets are in good condition. Clean rags are desirable for regular cleaning and wiping of motor housings, commutators and sliprings, and to keep windings clean. Waste should not be used, as it contains lint which may enter the parts.

Blowing out dust periodically with a blast of compressed air is good maintenance. The pressure should not be greater than 50 lb and the air must be free from moisture. Air suction can be employed in cases where a dust-free atmosphere is imperative. If the dirt is allowed to remain long enough, it will tend to unite with oil and grease and can then be removed only by using a solvent. Solvents require careful handling. Some are inflammable and others may be poisonous. Dust troubles can be eliminated largely by periodic cleaning.

A second cause of electric motor troubles is moisture. Moisture soaks and softens windings until the insulation will no longer hold the voltage. Once inside the motor, it unites with any dirt present to form a sticky composition. Moisture also absorbs acid and alkali fumes present in the air. Fumes of this type convert moisture into a destructive corrosive agent.

Preventive maintenance is the answer to the successful combating of moisture. This type of maintenance can readily be set up, according to the special condition encountered. Stand-by motors should be operated for a short time each week to guard against internal moisture condensation during periods of idleness.

The third chief reason for breakdowns is friction. In motors with sleeve type bearings, oil adheres to the rotating shaft and is dragged along as the shaft revolves. This forms the lubricating film necessary to prevent friction. It is important here that the right oil be used and that the proper quantity is applied. Manufacturer's specifications should be followed to the letter.

New oil should be added only when the motor is not operating, to avoid overoiling and a possible leakage into the commutator bars or into the windings. Excessive oil or leaking seals can "gum up the works" in general. On motors with ball bearings, the inner races of the bearings must be tight enough to rotate with the shaft and yet not so tight as to cause distortion.

The fourth chief reason for breakdowns is vibration. If excessive vibration is permitted to develop in a motor, parts can be shaken loose, connections broken, metal parts crystallized and frictional wear of every kind greatly increased. To avoid vibration, a few checks should be made regularly to eliminate misalignment and excessive bearing wear and to prevent the driven mechanism from transmitting impulses to the motor.

Periodic maintenance is as important on electrical control devices as it is on the motors being controlled. Starters, rheostats, contactors, relays, circuit breakers—all are readily maintained by following a regular checking procedure.

Westinghouse summarizes maintenance checks for electric controls as follows:

(1) Keep controls tight, clean and dry.

(2) Keep contacts free of copper oxide and in a moderately smooth condition.

(3) Check to see that moving parts are free, contact pressures firm and shunt connectors unfrayed.

(4) Surrounding temperatures of thermal relays should not be permitted to become abnormal.

(5) Keep control devices operating at rated voltages.

Jigs That Permit Fuselage Rotation

Sets of jigs which facilitate recovering and doping operations on fuselages were built by Otto Aviation Corp., Blairstown, N. J. The jigs are constructed from welded steel tubing and ordinary wood sawhorses.

A steel shaft is bolted to each end of the fuselage to serve as the supporting elements resting on the jigs. Bearings are provided on each jig for the axis points to make it possible to rotate the fuselage. Mounted on the jigs, the fuselages can be rotated through an arc of 320°, providing ready access to any part or area on which work is necessary, and at a height most convenient to the worker.

Similar jigs have been made for wings, while smaller ones were constructed for ailerons and parts of tail assemblies. The small jigs usually take the form of a sawhorse with a bearing of the hinge type used on the units being serviced. This arrangement provides for swinging the surface from one side of the sawhorse to the other.

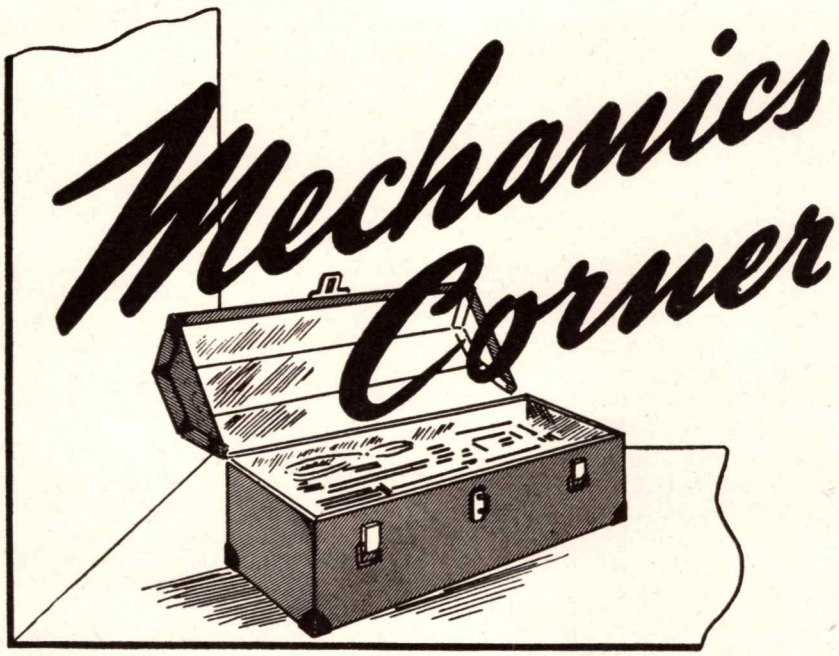
Tool Kit in Automobile Permits Flexible Service

Bateman E. Lewis, mechanic at the Stormville, N. Y., airport, carries a small tool shop in the rear deck of his car. A compartmented tool box is bolted into position on the floor of the car and provides ready access to the required hand tools as soon as the trunk lid of the car is raised.

This roadable shop simplifies and speeds up the servicing of disabled planes, whether they are on the home field or landed at some other point due to an emergency caused by a mechanical failure. All the equipment required for emergency service is immediately available at any spot where it is possible to drive a car.

The car is provided with a trailer coupling for purposes of towing, and electrical wiring and plugs are installed to provide light and small power for a trailer built by Lewis. It is a simple matter to arrange tail and clearance lights, should it become necessary to tow a lightplane fuselage at night.

Left: Jig and fixture used at Otto Aviation to permit rotation of fuselage during recovering and doping operations. Right: Tool kit in car brings road service to stranded aircraft



R. A. B.*

Procedures in Aluminum Welding

PRESENT indications are that aluminum and its numerous alloys may be expected to furnish a great part of the basic material necessary for aircraft construction and maintenance for some time to come. Welding operators will need to be familiar with such materials, and the different types of welding to be encountered. It is impossible here to cover an extensive analysis of the properties of the various aluminum alloys, or to offer a complete outline of the welding procedure to be followed in order to attain a high degree of skill. That is a joint problem of the airport management and the personnel involved. Only the most important factors can be discussed in one article.

Development of the proper technique for the welding of aluminum may easily be attained through diligent practice and observation of a few of the fundamental properties of the metal: (1) aluminum has a low melting point, approximately 1218° F, but will retain its silvery appearance even when approaching the melting point; (2) the metal usually needs support, otherwise it may suddenly collapse without warning when nearing the melting point; (3) aluminum has a high thermal conductivity. When the welding torch is applied to one point heat is carried along rapidly and dispersed throughout the body of the metal being welded.

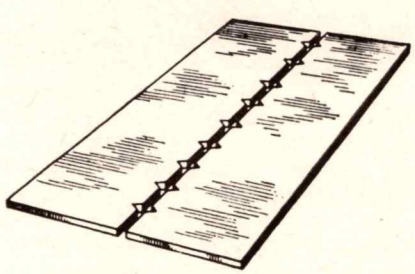
Two additional points relative to the high conductivity of aluminum are worthy of consideration: (1) due to the rapid spread of heat, little difficulty is experienced through contraction and expansion; (2) aluminum expands rapidly, yet is weak at high temperatures; consequently, cracks or checks are likely to appear in the metal unless allowed to cool slowly and evenly.

As to the welding process itself, three types of joints are used ordinarily for aluminum sheet: (1) for light sheets under 1/16 in, the flange joint; (2) for sheets above 1/16 in, the plain butt-type joint; (3) for all sheets above 1/8 in the edges should be beveled at a 45° angle to form a perfect 90° "V" for welding. In the welding of aluminum with the oxyacetylene torch, the steps for preparation of the sheets and the steps to be followed in welding are simple and easily remembered.

For aluminum sheets under 1/16 in, where the flange type joint is to be used, the edges of the metal should be thoroughly cleaned with a wire brush and water. The height of the flange joint should be approximately the same as the thickness of the sheet being welded. The projecting edges may be clamped down and hammered into shape with a wooden mallet, if no brake is available. The proper flux should be used and after it has been mixed with water to form a paste it should be spread very lightly on the metal with a brush.

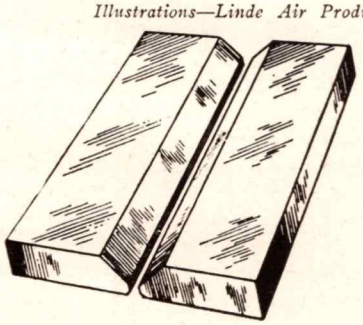
Next, place the metal edges in the jig or clamp in proper position for welding. The welding procedure is comparatively simple. In order to avoid the possibility of using an oxiding flame, there should be a slight excess of acetylene so that the outer feather will be considerably longer than the inner cone. No welding rod is necessary for this type of joint as the metal in the flange is melted down to form the weld metal. The flanged edges are again painted with flux, and by holding the inner cone reasonably close to the metal, heating both edges evenly, the welding will be completed with one pass of the torch. Surplus flux should be removed from the metal by use of a wire brush and water. This process should result in producing a smooth, ripple-type weld.

Butt-type joint on sheets over 1/16 in thick. Edges to be welded are notched 1/16 in deep and 3/16 in apart to assure penetration



A 90° single V joint for sheets above 1/8 in thick. Edges should be slightly separated and joint welded on both sides

Illustrations—Linde Air Products



*A Welding Supervisor.

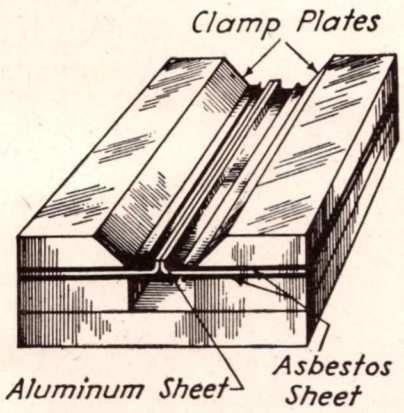
An almost identical procedure is used for the making of butt-type joints on aluminum sheets over 1/16 inches in thickness. However, the edges to be welded are notched to a depth of about 1/16 in, and about 3/16 in apart to assure proper penetration when fusion of the metal occurs. Also, the proper type welding rod is used, thoroughly coated with flux.

Heavy Sheets Are Beveled

Aluminum sheets above ⅛ inches in thickness should be beveled at a 45° angle to form an approximately 90° single-V joint. A blunt edge, about ⅛ in wide, should be left at the bottom, and the space between the blunt edges should be about 3/16 inches in width. The welding should be performed in two layers. Starting the first layer a short distance inward from one end, weld to that end, then complete the first layer to the opposite end. The second layer is completed in the same manner. However, for sheets more than ¼ in thick, it is usually necessary to create a puddle to secure a good weld.

There are a number of errors to be avoided in the welding of aluminum: (1) Do not attempt to melt the oxide skin which forms on the metal before it has been cleaned thoroughly. It would require too much heat, and may result in burnt holes in the base metal. (2) Do not use a "forced flame," too much heat in one spot. It likewise may produce holes, and through lack of proper penetration result in a faulty weld. (3) If an improper (neutral) flame is used, the high melting point oxides usually will cause the metal to ball up, resulting in poor penetration. (4) Speed is more or less essential, but if welding is carried on too rapidly, the weld will lack proper fusion even though it may have a good appearance on the outer surface.

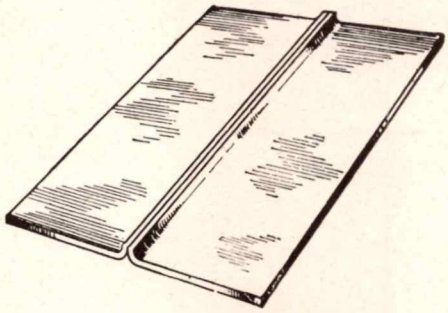
A simple type of jig suitable for clamping thin aluminum sheets for welding. Jig keeps hot and weakened metal from buckling



Both metallic and carbon arcs may be used in welding aluminum. Some authorities contend that better results are obtainable with arc welding than are possible with gas welding. The contention is that there is less likelihood of distortion and warping of the metal; that since preheating is practically eliminated and because of the rapid welding possible, the temper of the metal is less affected. However, aluminum sheets below 0.064 inches in thickness cannot be arc-welded.

Arc-welding on aluminum should prove no more difficult than oxyacetylene welding, providing a few fundamentals are carefully considered. The most important governing factors are: (1) proper preparation of the metal to be welded, depending entirely upon the gage or type, and the kind of joint to be made; (2) selection of the proper electrode suitable for the individual job is highly essential (the electrode used should have a lower melting point than the alloy being welded); (3) a number of aluminum alloys are "hot short," or brittle when hot, and have a high coefficient of expansion; (4) the correct flux should be used to remove the thin layer of aluminum oxide that interferes with the proper fusion of the filler electrode and the parent metal.

Flange-type joint for sheets under 1/16 in. No welding rod is necessary since the flange is melted down to form the weld metal



For the heavier metal where a puddle is created, regardless of the welding technique used, whether "forehand" or "backhand," the arc should be kept short. It has been found that the best results are obtained with an arc length of from ¼ to 3/16 in, and should not exceed ¼ in.

Emphasis must be placed upon the fact that a proper flux should be used in the welding of aluminum, regardless of the thickness of the metal, or method of welding. This flux differs from the flux used in the welding of other metals. Due to the lightness and quick settling of molten aluminum, it is necessary to use a flux that will act quickly, yet furnish a liquid carrier for the oxide which is considerably lighter than aluminum itself. The flux must have a melting point lower than aluminum, yet not be destroyed by the heat from the welding torch or welding arc.

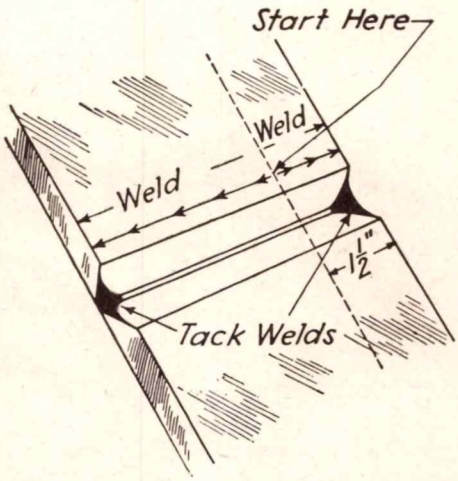


Plate welds should be started 1½ in from one end and completed to the near end. Weld can then be carried to other end

Detailed knowledge on the welding of different aluminum alloys and types of electrodes to be used is acquired only through considerable study. All experienced welding operators acquired their skill through observation and a lot of practice. It is true that each alloy ordinarily requires a different welding technique, and a certain type of electrode. For example, in the welding of *Alclad*, a flux-coated electrode is usually used, or a filler metal containing 5% silicon. If neither is available, one containing both silicon and copper may be used. One point well to remember is that welding may reduce the strength of heat-treated alloys. To overcome this, welded parts are given another heat-treat.

Knowledge of Job Important

One authority in the aircraft industry divides the maintenance technician's work into three parts: (1) Knowledge, or "know how," 50%; (2) ability to improvise, or adaptability, 25%; (3) common sense 25%; showing that the greatest emphasis is placed upon a knowledge of the job. This measure can be applied to work done on any component of an airplane.

It is evident that the efficiency of an airport operation depends upon the collective skill of the personnel in translating their "know how" into a cooperative enterprise providing beneficial results to all.

The solution to the problem of handling the aluminum alloys in their numerous forms requires faithful study on the part of the personnel indicated and a great deal of practice to develop the arts under study. Setting up a uniform system of operations and then applying close supervision is a task for management. A combination of the two should prove to be a direct and positive answer to the problem of making airport welding operations pay.

Finding the Navigational Stars

(PART 12)

BEN C. KENNY

A SERIES of articles about stars would hardly be complete without a discussion of magnitudes. Throughout these articles, stars have been spoken of as "dim," "bright," or "very bright." While these terms are sufficient to help the beginner recognize unknown stars, they are certainly not accurate quantitative descriptions of brilliance.

Astronomers and navigators use a standard system of notation to designate brightness, varying degrees of brightness being expressed by numbers known as magnitudes. The navigating star Aldebaran, for example, has a magnitude of 1.06. Dimmer stars have magnitudes designated by larger numbers.

A star of magnitude n is approximately 2.51 times as bright as one of magnitude n+1. The exact factor is the fifth root of 100. That particular value was chosen so that a star of magnitude 1.0 would be exactly 100 times as bright as one of magnitude 6.0, which is about the limit for dimness of naked eye stars.

The general terms "second" and "third magnitude stars" are applied to stars whose magnitudes are between the values 1.5—2.5 and 2.5—3.5 respectively. "First magnitude," however, is often used for all stars brighter than magnitude 1.5.

There are two stars so bright that their magnitudes are negative. They are Sirius (—1.6), the brightest of all the stars in our universe, and Canopus (—0.9). The following are nine of the first magnitude stars visible in the evening sky this month. Following each star is its magnitude as listed in the *Air Almanac:*

Aldebaran	1.1
Betelgeuse	0.1- 1.2*
Capella	0.2
Deneb	1.3
Pollux	1.2
Procyon	0.5
Rigel	0.3
Sirius	–1.6
Vega	0.1

*A variable star.

The accompanying illustration shows the south circumpolar stars and corresponds to the illustration with Part 10 of this series, which dealt with the north circumpolar region. The area shown here is that which lies within 42° of the south celestial pole.

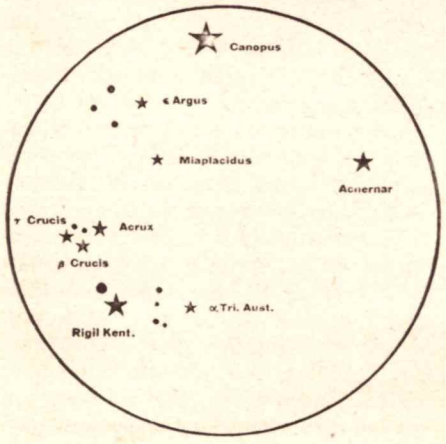
Most of the stars shown should already be familiar, as they have been discussed in earlier articles. Near the top of the picture is Canopus, the second brightest star in the sky. It is located south of Canis Major, as explained in Part 2.

East (counterclockwise in fig. 1) of Canopus is the false cross, containing the navigating star Epsilon Argus. South of that figure is the navigating star Miaplacidus, which cannot be seen from the United States. These stars were discussed in Part 3.

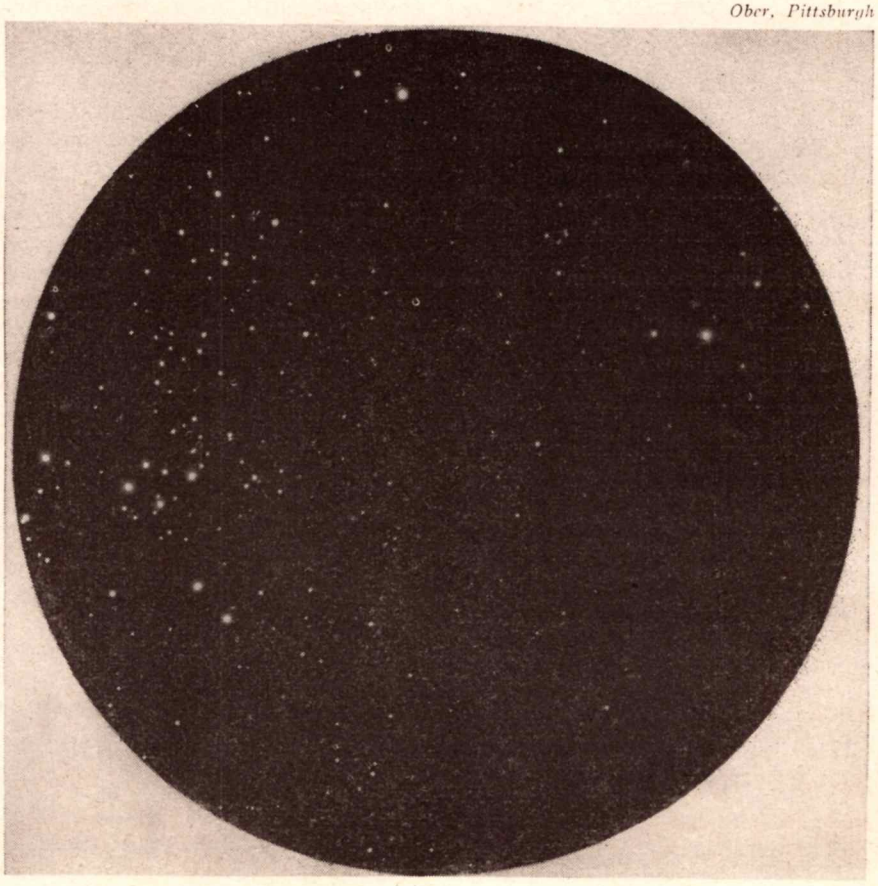
Moving eastward again, one comes to the brilliant little constellation Crux, the Southern Cross. Small as it is, Crux contains three navigating stars, Acrux, Beta Crucis, and Gamma Crucis. East of the cross, Alpha and Beta Centauri

(*Continued on page* 132)

Right: Portion of the southern sky lying within 42° of the south celestial pole. Key is given below



Ober, Pittsburgh



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forth it can and will devote its genius
and its efforts to the cause of peace;
that its planes will fly the air-routes
of the world in the interests of
trade and commerce to the end that all
men of all nations will arrive at
mutual trust and understanding, and all
the peoples of the earth can prosper;
can create instead of destroy,
and—eventually—win the peace for
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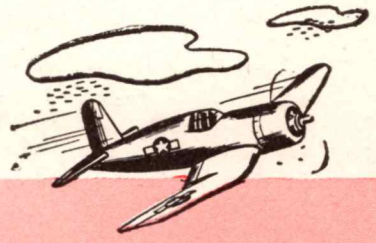
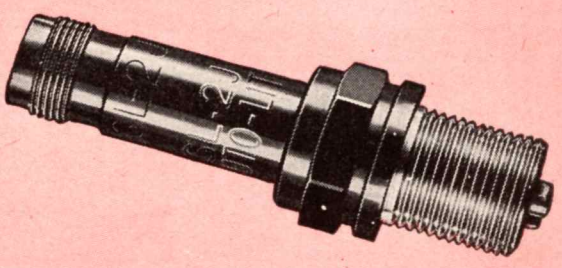
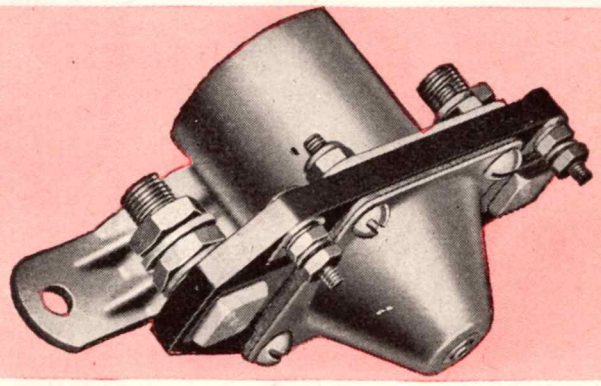


For years, one of the world's largest manufacturers of electrical equipment, Auto-Lite's 22 plants are today producing large quantities of fine electrical equipment for aircraft. Pictured here are some examples of these precision-built products.

THE ELECTRIC AUTO-LITE COMPANY
SARNIA, ONTARIO TOLEDO, 1, OHIO

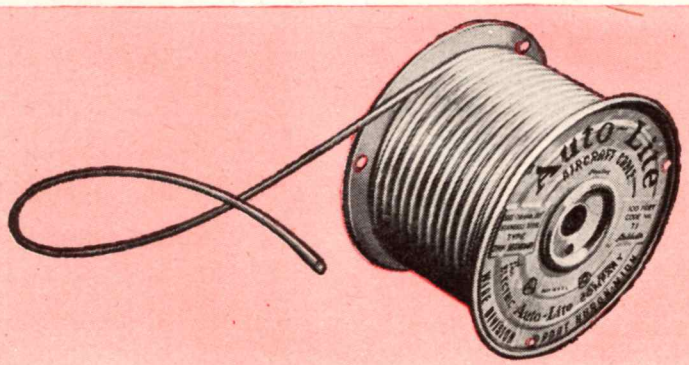


Outstanding features of these great spark plugs are (1) Direct contact non-inductive resistor located in coolest position in plug; (2) Deep drawn nickel alloy center electrode tip; (3) Improved copper cooled center electrode; (4) High Dielectric strength and superior mechanical properties of "Corundum," Auto-Lite's insulator material.



Combining the advantages of low-cost mass production and precision manufacturing, Auto-Lite relays are available for both continuous and intermittent duty. They are built to exceed the most exacting government requirements, achieving outstanding records in vibration, acceleration and altitude tests. Both types are operative from minus 60 deg. F. to 160 deg. F.

Auto-Lite batteries, noted for their brilliant performance records, are available in both 12 volt and 24 volt types. All are equipped with special non-spill vent plugs and assembled in either hard rubber or radio-shielded aluminum containers. The heavy duty battery has a capacity of 105 A.H. at 5 hr. rate; others have capacity of 34 A.H. at the 5 hr. rate.



Auto-Lite Steelductor Aircraft Ignition Cable is used as standard equipment in aircraft engines where wires are carried or held in place with metal guides or conduits. Some of its noteworthy features when in a shielded circuit, are: Longer cable life, increased life of spark plug electrodes and higher peak secondary voltages with the same primary coil current.

AUTO-LITE

TUNE IN "THE AUTOLITE RADIO SHOW" STARRING DICK HAYMES—CBS—SATURDAYS 8:00 P.M., EST

Open University of Illinois Airport

● Institutions of learning are fast awakening to the growing need for a practical education in aviation as evidenced by the University of Illinois which recently opened and put into operation the largest and best airport owned by any university.

Both Park Livingston, president of the University Board of Trustees and University President A. C. Willard gave Governor Green "primary credit" for the $2,250,000 airport because of the Governor's cooperation in the passage of necessary legislation and the appropriation of state funds.

While the airport will not be finished before next year, enough installations have already been completed to enable the field to operate as a commercial airport, accommodating 14 airlines. It is also operating as a training base for Army and Navy students as pilots and technicians.

This airport embraces 762 acres and is larger than the Chicago municipal airport, thereby setting an example for that city. There are three runways, each 5300 ft long and 150 ft wide, and these are paved with concrete 8 in thick. A fourth runway is turfed and is 4000 ft in length. Taxiways paved with concrete total 12,000 ft. These are 50 ft wide and are covered with concrete 9 in thick.

Runways for Heaviest Planes

Both runways and taxiways will sustain a gross plane load of 100,000 lb for continuous operation. Intermittent landings and takeoffs of planes weighing 130,000 lb could be accommodated.

Total paved area is 338,000 sq yd which is equivalent to 29 miles of highway surface 20 ft wide. Some 89,000 ft of drainage pipe, equivalent to 17 miles, was employed. The hangar is 360 ft long and 100 ft wide, with 600 ft of 20-ft lean-tos to be used for classrooms and laboratories.

The site, six miles from the campus, is so located in the center of a four-sq-mile area that there is adequate provision for future expansion. The University owns land which would permit 1600 ft extension of the runways likely to be used the greater part of the time.

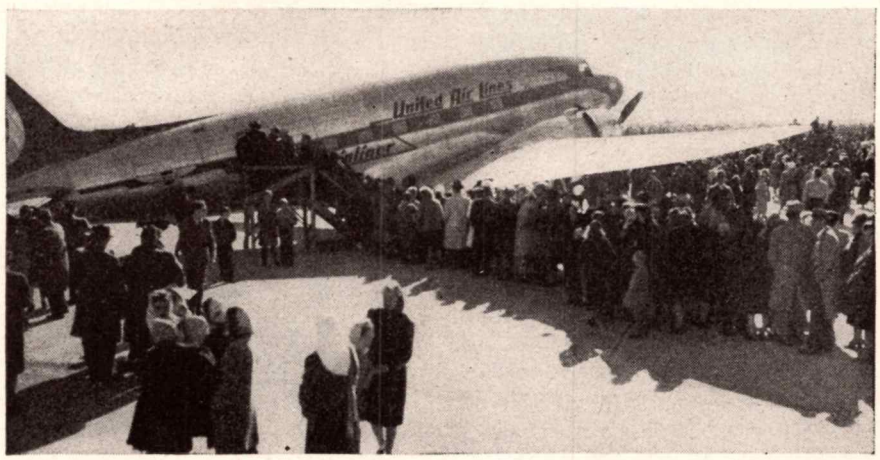
At the dedication both Governor Green and Senator Lucas united in urging that flight training of students be a major objective of the University airport program, and they recommended, particularly, that the field be utilized for aerial ROTC training of reserve flying officers for the armed forces.

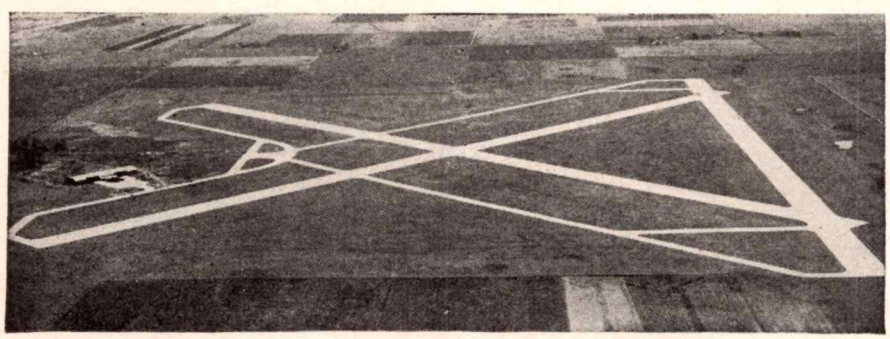
President Willard revealed that the University has already applied to the War Department for establishment of an Air Corps unit of the ROTC, and he pledged that the airport "will be available for any use the Army and Navy may desire to make of it as a part of their training programs." Both men emphasized the contribution to national defense which the University may make through its new facilities.

Governor Green said: "Above all, I hope the facilities of this airport will be used to teach students to fly. It is expected that soon the University will have the instructors and the planes to qualify students for private pilots' licenses, and possibly advanced ratings. For certainly the youth of today wants to fly, and there is no better place to learn than in a University that has the proper facilities for such instruction.

May Train Flying Officers Here

"Also, it is our hope that the University ROTC, which has been of so great benefit both to its members and to their country, will be able to train reserve flying officers here. It is clear to all of us that aviation now has a major role in national defense, and the University of Illinois will be prepared to participate fully in the aviation program of the ROTC."





Above: Part of crowd at dedication of University of Illinois airport with United Air Lines mainliner "Illinois" in background. Left: Aerial view of 762-acre U of I airport which has four functions: education and research; commercial service; private flying service; and military training

The Canuck Model 80 "embodies stall characteristics that are unique and safe, and it will recover from an abnormal attitude without assistance"

The Fleet "Canuck"

G. E. OTTER
Chief Engineer, Fleet Aircraft, Ltd.

THE experience gained during the war in the design of wing sections and certain other aerodynamic features has contributed much to make the *Canuck* a speedy and outstanding two-passenger personal aircraft. The first of the post-war designs contemplated by Fleet Aircraft Ltd., Canada, Model 80 embodies stall characteristics that are unique and safe, and it will recover from any abnormal attitude without assistance.

Noticeable features are its balanced proportions, smooth flowing lines, neat upholstering, complete instrument panel, wide seat, soft durable airlock cushions and a spacious luggage compartment. This compartment is large enough to carry a tent and bed-roll.

A pilot will notice the absence of the usual blind spots when taxiing on the ground or when turning in the air. In flight, the engine cowl is well below the horizon and below the runway on the approach. The pilot's view is unrestricted through 350° in the horizontal plane, 170° from the top of the cowl backwards and unlimited laterally from the wheel to the sky.

The airfoil section was chosen to give a high $\frac{L}{D}$ ratio, a gentle stall and good recovery from a spin. Lateral and directional control of the airplane in trimmed flight can be obtained by the use of ailerons alone, rudder alone, and a third method—not usually recommended—by the doors alone. A high aspect ratio fin and rudder are used for increased efficiency. There is no change in trim between the power-on and power-off condition.

Just prior to stall, a little tail buffeting gives warning of the approaching stall. At the stall the nose drops

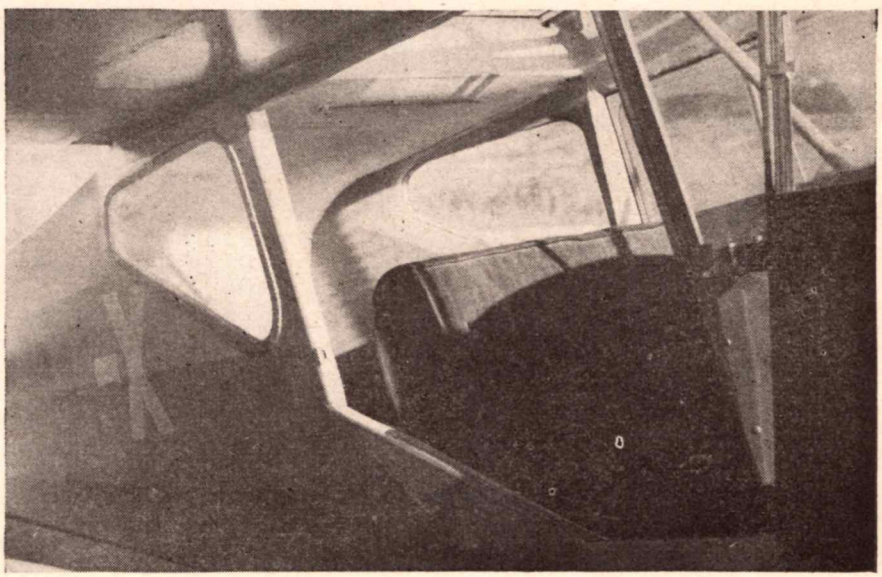
(Continued on page 122)

Performance at 1425 lb at Standard Sea Level Atmosphere

Maximum speed	108 mph
Cruising speed, 75% power	100 mph
Stall (estimated)	45 mph
Rate of climb—sea level	550 ft/min
Service ceiling	12,000 ft
Range of cruising speed	400 miles
Fuel consumption	25 miles per gal at cruising speed.

Weights:	
Weight empty	858 lb
Fuel 16 Imperial gal	115 lb
Oil 1 gal	7.5 lb
Pilot and passenger	340 lb
Baggage and extra equipment (fire extinguisher, starter, etc.)	104.5 lb
	1425.0 lb

The cockpit of the "Canuck" showing the passenger and pilot seat and baggage compartment



EXCLUSIVE!

The Pan American World Airways System has authorized the Charles H. Babb Company to dispose of a large quantity of aircraft equipment from its various bases. Included in this inventory will be aircraft and engine parts and accessories, tools, radio equipment, aircraft and aircraft engines.

Airlines—fixed base operators—aero clubs—overhaul stations—private owners—Materials now are available to you at attractive discounts, either by lot or by item. Here is an opportunity to purchase needed repair and maintenance equipment, to build up depleted stores—at minimum cost.

Engine Parts, Accessories

Bearings, pistons, cylinders, gears, major and minor engine parts, generators, pumps, magnetos, radiators and other accessories for most of the following engines—Twin Wasp S1C3-G and S2A5-G, Wasp Jr. SB, SB2 and SB3, Wasp B, BCD, B-1, C, C-1, SC-1, D-1, S1D1, T2D1, S1H1, S1H1-G, S3H1 and S3H1-G, Hornet B, C, D and S1EG, Wright R760E-2 and R975E series. Pratt & Whitney tools and tool kits.

Engines

Wasp T2D1 and Hornet S1EG engines available in quantity, either overhauled or in as is condition.

Aircraft Parts, Accessories

Large inventories of Lockheed Lodestar parts and accessories; Sikorsky S-42 and Consolidated Commodore spares, including beaching equipment, parts, furnishings and fabrics. Radio parts—Goodyear, Hayes-Palmer, Bendix spares—Vickers pumps repair parts.

Continued release of additional materials will be handled by the Babb Company. Forward your inquiries to our New York or Glendale offices—lists, prices, discounts, locations of merchandise will be sent you promptly.

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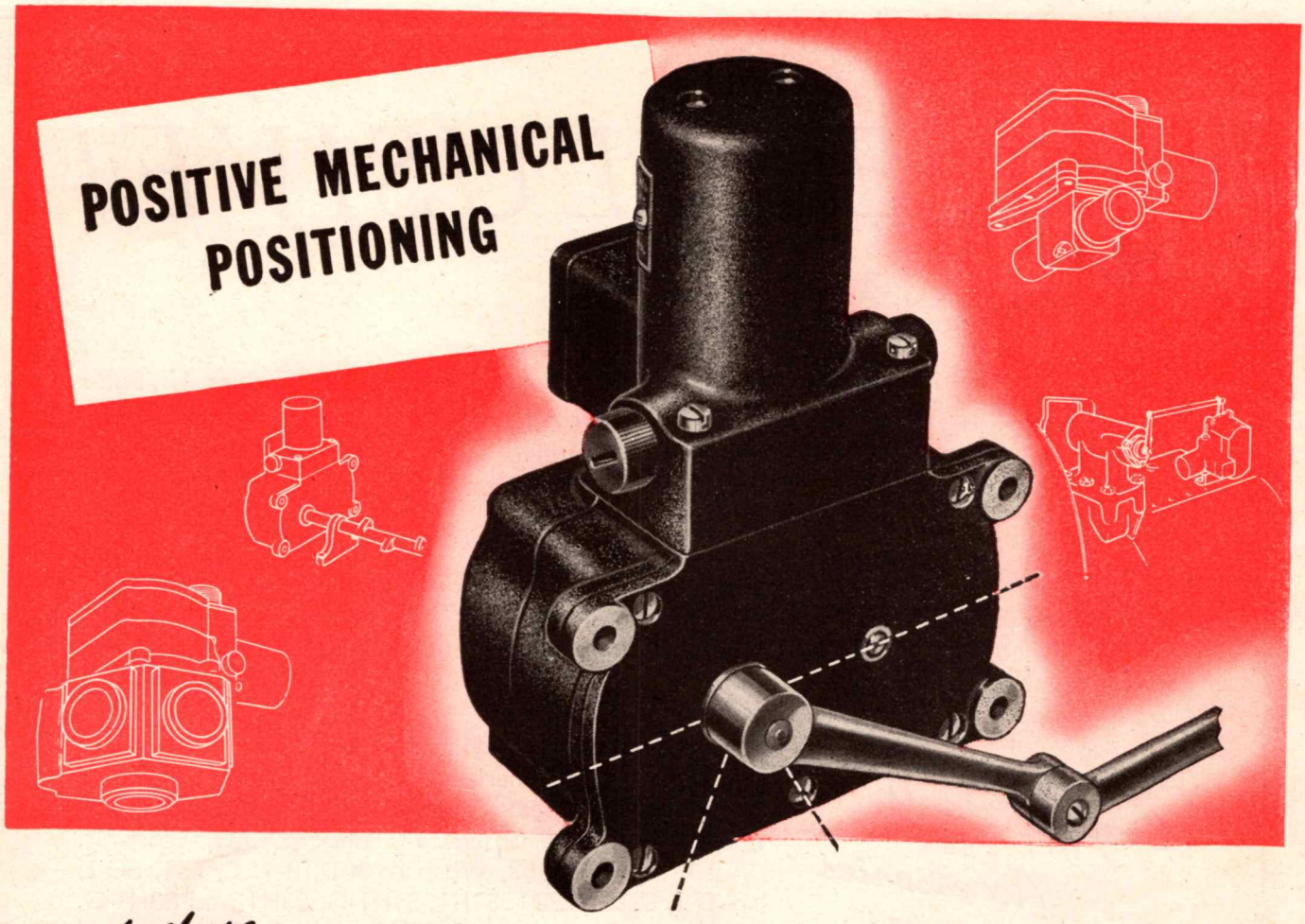
POSITIVE MECHANICAL POSITIONING



with these

GENEVA-LOC ELECTRIC ACTUATORS

FOUR TYPICAL MOVEMENTS

4 POSITION 90°

5 POSITION 72°

3 POSITION 45°

2 POSITION 60°

The exclusive geneva cam action rotates the shaft to the exact positioning, then locks it against movement. This mechanically controlled positioning is completely independent of motor overtravel and permits the elimination of all adjustments, brakes and clutches. The Geneva-loc Actuator requires no attention, and no adjustment is necessary when one actuator is replaced with an interchangeable model, thus simplifying aircraft maintenance.

Geneva-loc Actuators are currently being used on numerous military and commercial airplanes to actuate shut-off valves, fuel selector valves, hydraulic directional control valves, air duct butterfly, carburetor mixture controls, doors and supercharger control levers. Model LM-108 illustrated above weighs 1.9 pounds.

The high speed motor starts and stops at no load and the gear ratio is constantly variable, starting and ending at infinity. This results in smooth starts and stops and extended motor, gear and switch life. Geneva-loc Actuators can be used advantageously on any installation where the positions are predetermined and if more than 2, equally spaced. Standard units have travel increments of 45°, 60°, 72° or 90°. Pacific Division engineers are available to assist you.

Write for Bulletin BA 102.

Pacific Division
Bendix Aviation Corporation
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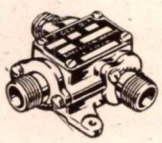
the powerful action of weight and space saving

ECLIPSE LINEAR ACTUATORS

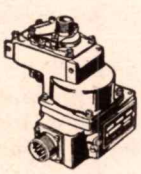
Designed by Eclipse, the leading name in aviation accessory development and production. As far back as 1931 we produced aviation rotary actuators for the planes of that era . . . and today for the fastest planes built.

Eclipse engineers can help you apply *concentrated might* to your new aircraft designs where weight, space and dependability are all important. Write today for installation drawings and performance curves.

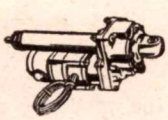
REMEMBER—ECLIPSE SERVICE FOLLOWS THROUGH FROM DRAWING BOARD TO SKY

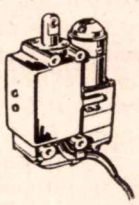


Eclipse Type 1601 Actuators utilize a central power unit to drive any combination of screw jacks through flexible shafts.



Eclipse Type 1600 Actuators are available in pairs (left and right hand) for application where simultaneous movement of two elements is desired.





Eclipse Type 1602 Actuators are small screw-jack types with integral motors, gearboxes and limit switches.

These are only a few of the wide range of types and models produced by Eclipse.

Eclipse

REG. U.S. PAT. OFF.

AVIATION ACCESSORIES

PRODUCT OF Bendix AVIATION CORPORATION

Eclipse-Pioneer Division • Teterboro, N. J. • Los Angeles 36, Calif.

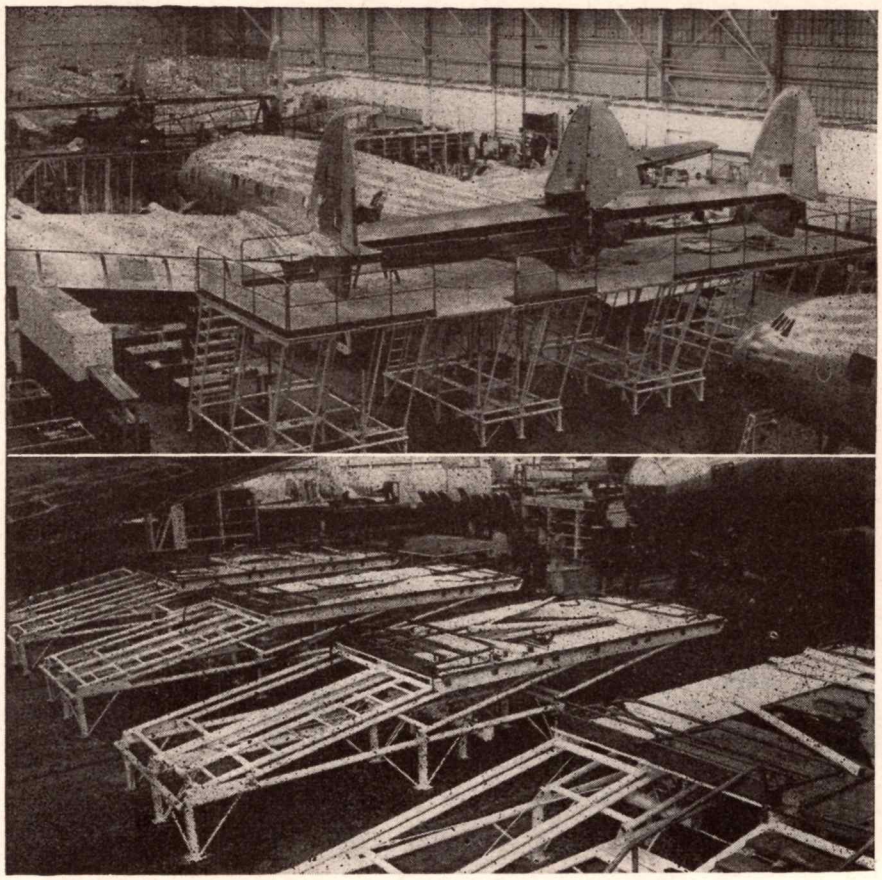
All-Purpose Workstand for Aircraft

● Pacific Engineering's *Aerostands* are well known in the industry and are in general use in many countries of the world. Now the company announces a huge stand which has been used on the C-69 *Constellation* production line at Lockheed and which, it is pointed out, would also solve many problems for the airline operator who must keep a fleet of four-engined (or bigger) airplanes in constant readiness for scheduled flights on a big time basis.

The smaller *Aerostands* are designed for the production line or the servicing and maintenance of smaller aircraft, and are used on the bigger planes, too. They would still be used in conjunction with the large model.

The large *Aerostand* was designed by Pacific Engineering Corp. to meet Lockheed specifications for production work on final assembly of the *Constellation*. It is 39½ ft long and is broken into four sections to make room for the landing gear to pass between sections. Each set of two stands is operated by a 2-cylinder hydraulic pump as it is raised from a wholly collapsed position to a height of 11 ft, 8 in, or any desired height in between. A release valve is actuated to lower the stand.

The stand is constructed of welded lightweight high carbon steel tubing. Steps are parallel with the floor at all times, whether the stand is raised or lowered. The top is a 1-in light plywood flooring, so constructed that flaps will fold back at any desired point on the work surface.



Upper photo: Stands in use on "Constellation" tail assemblies. Full floor and safety rails are provided. Lower view shows stands in lowered position, permitting plane to be moved over the top

One Type Stand Sufficient

The *Aerostand* is designed to take the place of platforms built to a set height which must be moved out of the way when a plane is to move out of the hangar. No two planes are alike as to the height of the various installations that must be serviced, necessitating a number of platforms that are moved up and replaced by others as different operations are performed. The *Aerostand* stays where it is, bolted to the floor, and may be raised or lowered to whatever height is called for by the next job to be done. When the plane is ready to move out, the stand is lowered, another plane moves up to take the place of the one just moved out, and the stand is raised to the desired height.

This type of workstand is economical in an operation where big airplanes are moved in at one end of a hangar and out the other, especially if there is a whole line of planes waiting to be serviced. It is not necessary to move a lot of other planes out of the way to release one that may be ready. Even in a single-door hangar, the fact that a plane may be moved in and out the same door without the necessity of moving a lot of equipment around to get the plane out again is a great time-saver.

Aircraft companies have customarily built as many as 30 or 40 different types of workstands for assembly and servicing operations on each model airplane in production, or while being modified or serviced. These stands are apparently cheap. However, when considering the fact that each one must be engineered, specially constructed, and then discarded when that particular model airplane is no longer being serviced, the cost is quite high. *Aerostands* are constructed to last indefinitely as a permanent piece of equipment, and need not be discarded when a different model airplane comes along.

Aerostands are used for engine work, wing and empennage stands, entrance ladders and passenger loading stairs, baggage compartment loading stands, washing and cleaning stands, paint stands, and, by use of a hoisting attachment, as a hoist for propellers, tail surfaces and other light units. The platforms of the various models are large enough to allow several mechanics to work on the same job. Workers are protected by guard rails and the parallel steps are much safer and easier to walk on than ladders. Maintenance accidents are reduced to a minimum.

. . . made possible with Sperry Model A-12 Gyropilot*

WITH suitable Runway Localizer and Glide Path Control equipment, the Sperry Model A-12 Gyropilot makes possible automatic landings under all conditions of visibility.

This Sperry Gyropilot takes over completely the task of seeking and adhering to the beam on the approach and lands the plane unerringly . . . the most exacting function any automatic pilot can perform.

The human pilot with the A-12 Gyropilot has complete gyro-stabilized control of his aircraft at all times...

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- Automatic holding of any selected altitude

- Automatic trim of elevator controls regardless of changing load conditions
- Utmost in passenger comfort—precise control and elimination of over-control, "hunting," and "wallowing"
- Electrical and mechanical interlocks—automatically insuring proper manual operation
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These and other features of the new Sperry A-12 Gyropilot introduce a new era in automatic flying. Write our Aeronautical Department for further information.

*TRADE-MARK REG. U. S. PAT. OFF.

SPERRY GYROSCOPE COMPANY, INC., GREAT NECK, N. Y.

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Maintenance SHORT CUTS

The Short Cuts award is made for the item judged best each quarter. Award for the fourth quarter of 1945 will be announced January 1, 1946.

Hinged Tool Holds Canvas Sides for Lacing Operation

A holding fixture to pull together pieces of canvas and hold them in alignment while lacing bunks was designed by Leo P. LaVigne, an employee of Douglas Aircraft, Santa Monica.

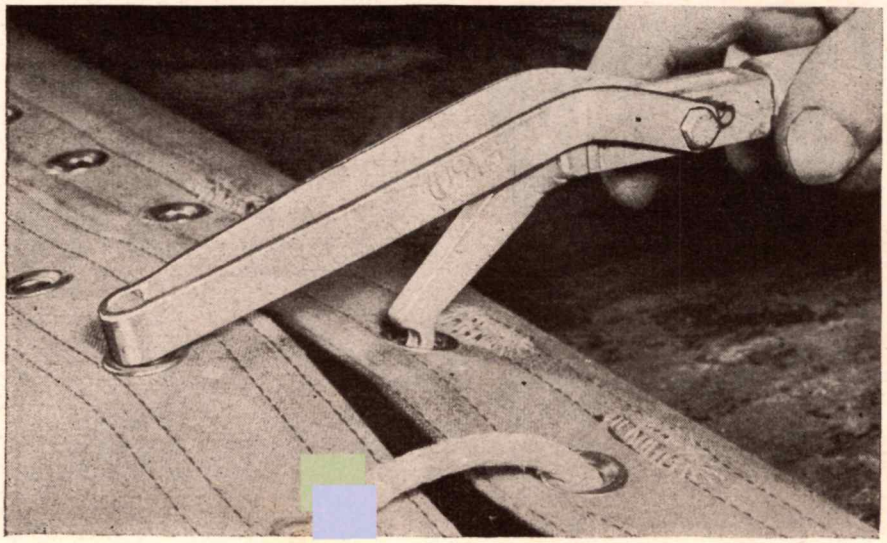
Formerly, when lacing the bunks, it was necessary to thread the lacing into the eyelets of the bed and in the canvas secured to the frame. Then the two parts were pulled together by hand until the bunk canvas was taut. This job proved to be particularly fatiguing and there was always the possibility of an injury to the worker due to overstraining while pulling.

This tool is used to pull the canvas to the correct tension and hold it there while rope lacing is threaded through the eyelets. One major part of the tool is in the form of a yoke. The closed end of the yoke mounts a curved pin which is positioned in an eyelet of the bunk canvas when in use. The other jaw of the tool is attached to the open end of the yoke by a clevis bolt which permits the two parts to work on a hinge action. One end of this jaw has a curved pin to be inserted into an opposite eyelet when in use on a lacing operation.

The tool handle and inner jaw are mounted to the open-end yoke by a clevis bolt, through a slot which permits adjustment to varying job requirements. This adjustment is obtained by screw action in the handle of the tool.

In operation, the curved pins on the jaws are inserted into opposite eyelets and the parts contracted in the manner of closing the blades of a jackknife, drawing the canvas pieces together in the process. More than 1000 man-hours were saved annually and fatigue and the possibility of bodily injury were lessened.

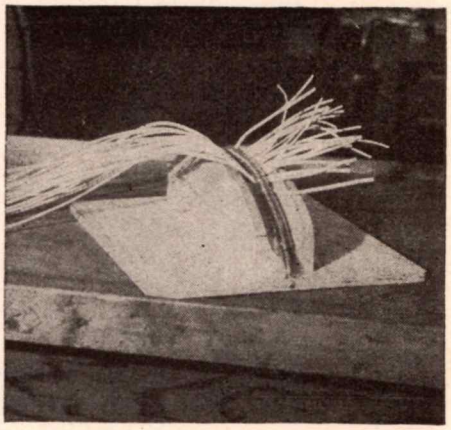
Canvas sides are pulled together for rope lacing at Douglas Aircraft by a toggle-action tool designed by an employee. An adjusting mechanism adapts the device to various openings



Clamping Device Holds Ends of Electric Cable Bundles

At the suggestion of Alice M. Ferguson, an employee of The Glenn L. Martin Co., a clamping device was originated to hold ends of electric cable which were being assembled into bundles.

Formerly when electric wiring was assembled in bundles previous to installation, the worker had no means of holding the ends of the wires in alignment. Masking tape was tried but proved unsatisfactory because some wires were pulled out accidentally or fell to the floor, became tangled and sometimes actually lost.



Rounded block supports a coil spring used to hold ends of electric cable while being assembled into bundles at The Glenn L. Martin Co.

The suggested holder consists of a half-round wood block mounted on a plywood base. A groove is machined into the rounded portion and a long coil spring is installed to apply tension over the grooved surface.

In use, the operator grasps the cables with one hand, lifts the coil spring with the other and slips the bundle of wires underneath. Releasing the spring applies tension on the wires, clamping them into the groove of the wood block and securing them for any operations needed.

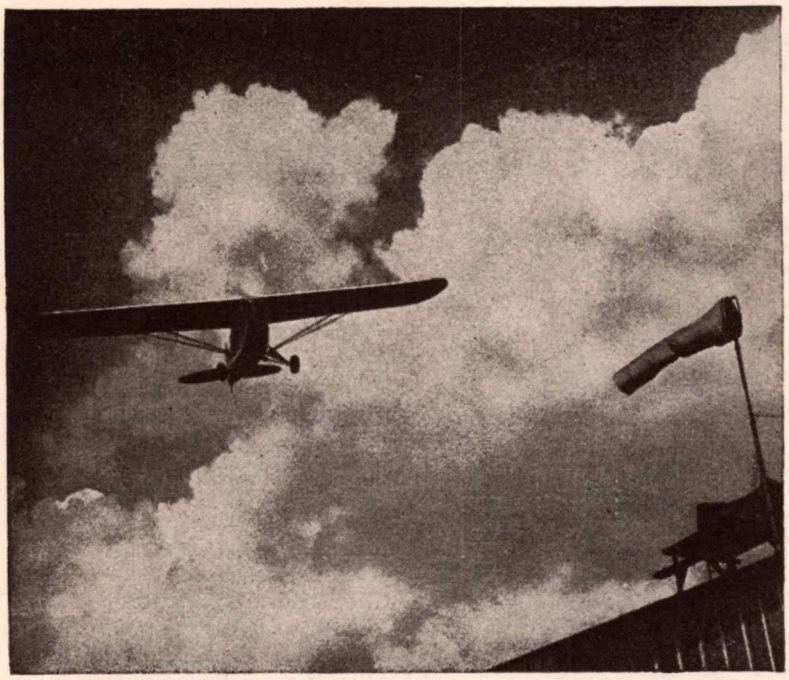
This device makes it possible to obtain a neater bundle, leaves the ends readily accessible and saves the time formerly spent in locating and straightening wires.

Device Aids Push Rod Housing Installation

Under the Navy Employees' Suggestion Program, Herschell Woolsey, a worker at the Corpus Christi Naval Air Station, devised a useful and handy tool for removing and installing the rubber hose coverings on engine push rod housings.

(*Continued on page* 74)

boost airport income with this down-to-earth plan!



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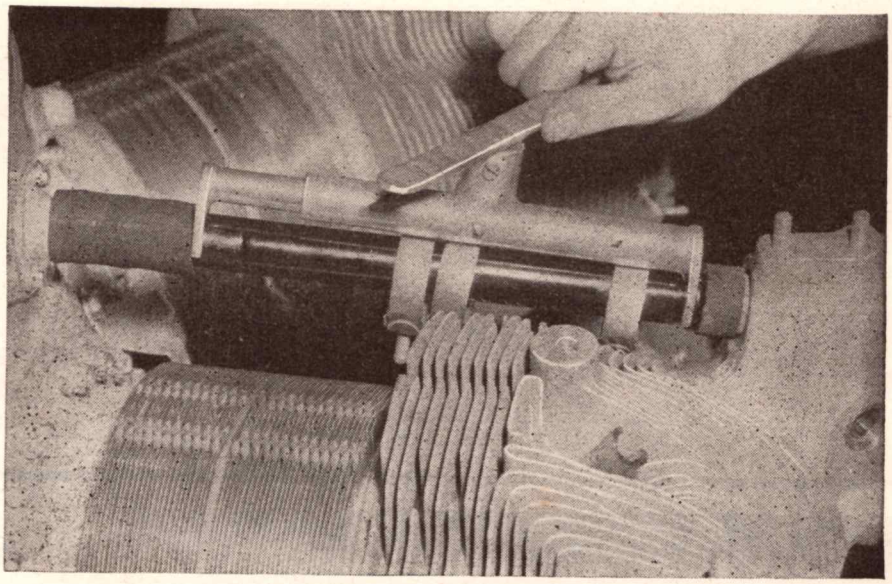


Push rod housing installation has been simplified at the Corpus Christi Naval Air Station by a tool developed to aid in the proper positioning of the rubber housing seals. The device, made of a lightweight metal, can be utilized either as a pushing or a pulling tool

(*Continued from page 72*)

This device, less than one ft in length, and constructed of lightweight metal, consists of a housing shaped into a fork at one end, large enough to fit around the push rod housing. A smaller rod, with a gear rack machined along a part of its length, is positioned inside the larger tube and provided with a similar fork at the end opposite the gear rack.

A "T" handle with a small gear on the shaft end is inserted into the main tool housing to actuate the rack and fork when rotated, thus either lengthening or shortening the tool, depending upon the direction of rotation.

The tool is used first to install the rubber tubes on the ends of the push rod housings and later to complete the installation of the housing on the engine. In the first instance, the rubber tubes are started by hand and then forced over the housing by setting the tool against the ends and causing the fork ends to contract. After positioning of the push rod housings on the engine, the tool is positioned and caused to expand, pushing the rubber seals into position ready for the retaining clamps.

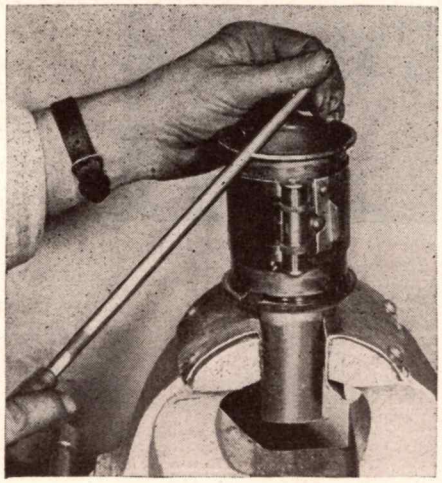
Use of this device makes it possible to perform these installations faster and with greater safety, replacing a lever-type tool previously used. Estimated annual savings are $600.

Ring Compressor Secures Bearing for Modifications

Maurice M. King, an employee at the United Air Lines' Cheyenne maintenance base, suggested the use of a clamp type ring compressor to secure a master rod bearing on a jig while modifying bearing lug slots.

The steel jig is clamped into a vise for a solid support and the bearing held stationary on it by the clamp. Rework on the locking slots was speeded to the extent where 50 man-hours were saved on a total of 400 half bearings modified.

Clamp-type ring compressor holding a master rod bearing to a jig during modification of bearing lug slots at United Air Lines



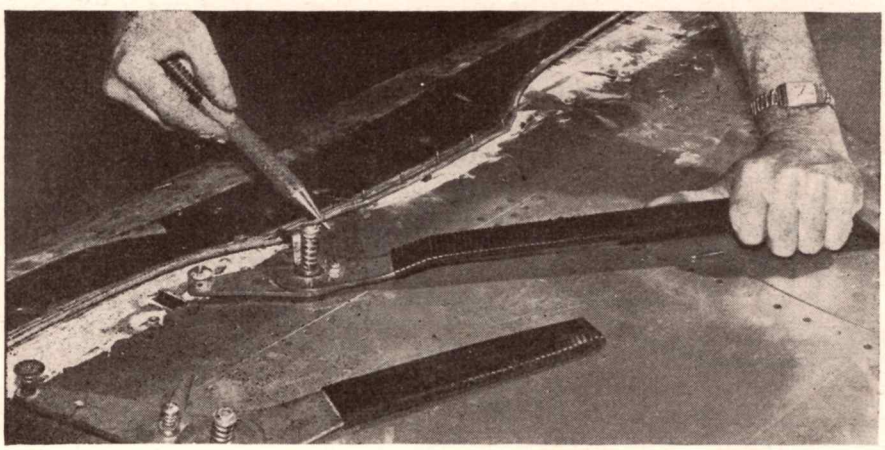
De-Icer Boot Pulled into Position by Aligning Tool

Rex Pagett, employed at Northrop Aircraft, devised a de-icer boot stretching tool which saved 30% of the time formerly required on an empennage and released one man for other work.

The tool consists of a 6-in flat adapter bar provided at one end with a pin to fit into *Rivnut* holes. A 12-in flat bar, shaped to form a convenient handle, is joined to the adapter bar by a single bolt to permit a hinge action. An adjusting feature on the handle mounting makes provision for the tool to be used at various angles, sometimes necessary in closely confined areas. To this combination is added an extension hook to fit into the holes along the edges of de-icer boots.

In operation, the anchor pin on the end of the stretcher is inserted into a *Rivnut* hole, used to secure the boot on the aircraft surface. The hook is inserted into a hole in the boot, and by moving the handle, the edge of the de-icer is pulled into position on the surface, where it can be secured by temporary pins or by the permanent fasteners.

This job has now been simplified into a one-man operation. The former tremendous fatigue factor is reduced approximately 75% and some material normally damaged is now saved. This device can be used on either wing or empennage surfaces on aircraft of all types and on all Goodrich de-icers.



De-icer boots may readily be pulled into position by an aligning tool devised at Northrop Aircraft. The tool affords ample leverage, fits into the standard installation holes and prevents injury to the worker and damage to material. It can be used on wing and empennage surfaces

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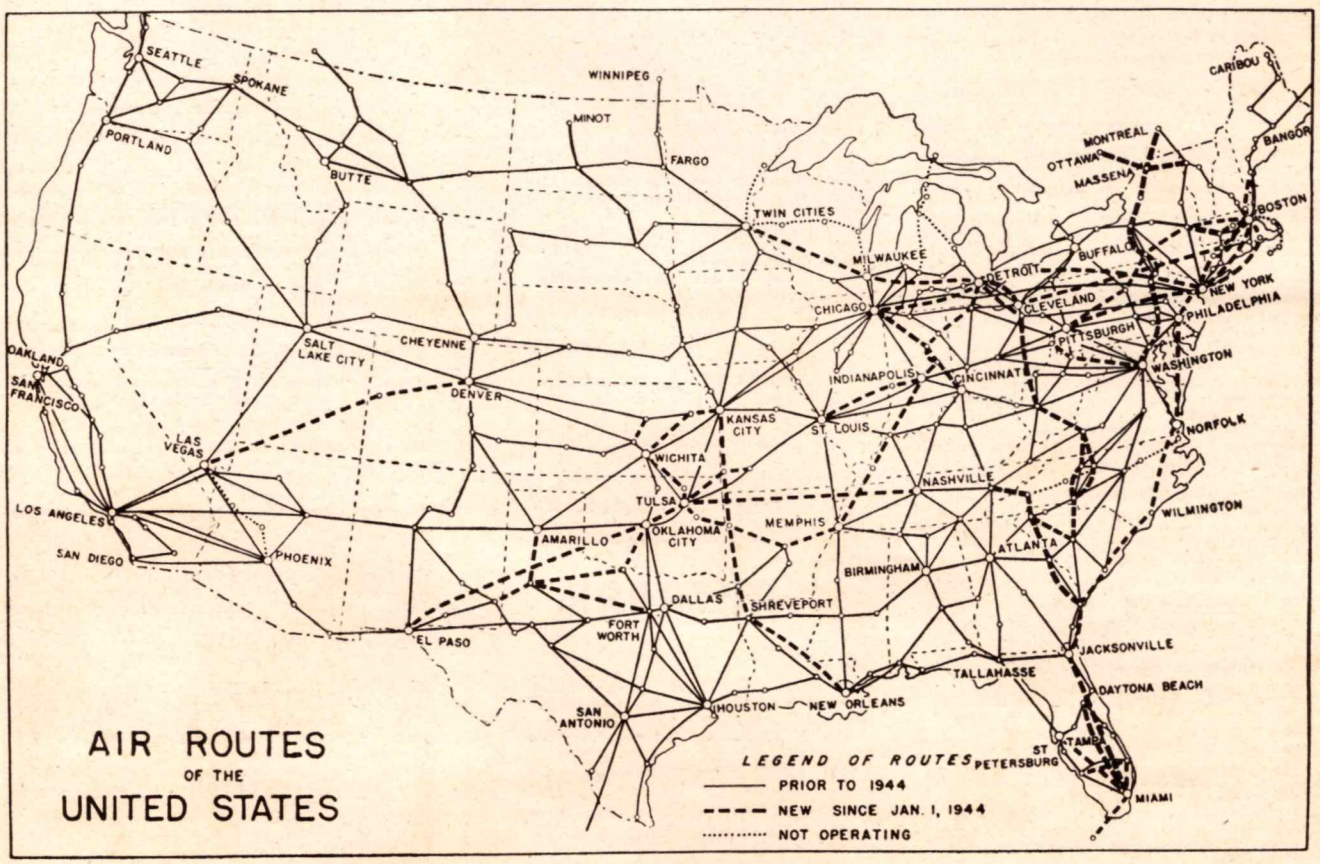

NAVY—WHY NOT?

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be applied to both our naval and commercial activities.

"The rigid airship's value in a naval sense arises from these characteristics:

(1) High speed—two and one-half to three times that of surface vessels, and about one-half to one-third that of airplanes.

(2) Wide speed range—zero to maximum of, say, 75 knots. Ability to slow or stop engines and hover. Sustentation by helium gas.

(3) Steady, vibrationless, elevated platform. Ability to detect objects in water and keep them under close scrutiny as long as desired.

"The degree of vulnerability of airships to aircraft attack should be recognized, and be considered in assigning tasks appropriate to the airship's capabilities. The ability of large airships to carry airplanes, together with their self-sustaining qualities, places them in a class comparable to that of other airplane carriers, and particularly to that of cruisers—as scouts.

"A comparison of the scouting capabilities of modern cruisers and their airplanes, with rigid airships carrying airplanes, can be stated somewhat as follows:

(a) The cruiser is capable of about 30 knots sustained speed for about 3 days.

(b) A modern rigid airship (of *Macon* type and class) can be capable of about 60 knots sustained speed for about 6 days.

(c) The rigid airship, as described, therefore, is capable of operating at twice the speed of the cruiser for twice as long or, in other words, can cover four times the distance or 16 times the area.

(d) For strategic uses, the rigid airship affords scouting capacities which are impressively important.

"The geographical situation of the United States and of its overseas possessions and dependencies, taken into consideration with potential enemies in the Pacific and in the Atlantic, imposes readiness not only for overseas operations but for operations at long range —for both of which the rigid airship is adapted. Thus:

Scouting: (1) search operations at long range; (2) contact scouting (strategic); (3) observation; (4) reconnaissance.

General: (1) neutrality patrols; (2) locating enemy commerce raiders; (3) convoy of merchant vessels; (4) location of mines and submarines; (5) bombing (by planes) under certain conditions.

Miscellaneous: (1) radio station calibration, as radio relay, direction finding, etc.; (2) as special communication station; (3) transport of special personnel or supplies; (4) as "assisted takeoff" means for overloaded airplanes.

"The Federal Aviation Commission, in 1935, endorsed the building of a 3,000,000-cubic-foot airship for naval training, and recommended a basis on which a two-airship commercial device could be established.

"The business advisory council to the Secretary of Commerce, in 1936, adopted a report of its aviation committee recommending the enunciation and recognition of a national policy favorable to airship transportation and recommended certain specific steps to give impetus to that policy.

"A special committee on airships of the National Academy of Sciences (the Durand committee), appointed for the purpose of studying the situation, has endorsed airships as safe and practical vehicles of transportation. There is need for a national policy with reference to the lighter-than-air branch of aeronautics.

"The Navy Department currently holds obligation to the United States for practically all developments in the lighter-than-air branch of aeronautics (except observation and barrage balloons). Since no other Government agency is at present engaged in airship activities, the Navy Department's attitude toward airship matters is likely to be the deciding factor in shaping not only the Navy's own lighter-than-air affairs, but the attitude of the country as a whole toward this branch of aeronautics.

Navy's Uncertain Attitude

"For the past five years the lighter-than-air situation in the Navy has been either static or growing worse, due to uncertainties as to the attitude or future policies of the Department. This indefiniteness in the Navy's position has been a handicap not only as related to the Department's own program, but in that it has served also to retard or discourage the development and establishment of commercial airship service and the availability of such airships as naval auxiliaries.

"The restatement of naval policy recommended by the General Board in February, 1937, reaffirmed in October, 1939, is considered sound, viz:

'To build and maintain nonrigid airships in numbers and classes adequate for coastal patrol and other essential naval purposes.

'To explore the possibilities of developing rigid airships to meet naval requirements, to cooperate with other agencies in developing large commercial airships, and to continue personnel training.'

"Steps in a logical, conservative, minimum program are considered to be:

'Approve the broad naval policy toward lighter-than-air recommended by the General Board, and accompany this by general recognition that airships are a legitimate and useful part of naval aeronautical activity.

'Definitely offer naval encouragement and support for the establishment of commercial airship services, going so far as to recognize that the special character of the prevailing situation demands that the Navy should urge upon Congress and other appropriate Government agencies the desirability of bringing commercial airship service into being.

Principle of Government Aid

"Endorse and support the general principle of Government aid for commercial airships, as broached by currently pending legislation.

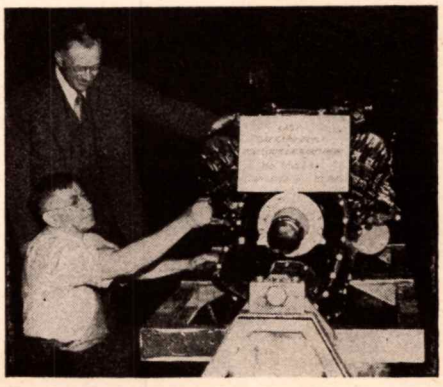
"The adoption of the General Board's recommendation and the adoption of the measures recommended in this report as to a program which implements such approved policy will bring about definite developments as to rigid and nonrigid airships and the personnel who man them. The data and evidence now available as to the performance and utility of both nonrigid and rigid types of airships justify proceeding with such a program."

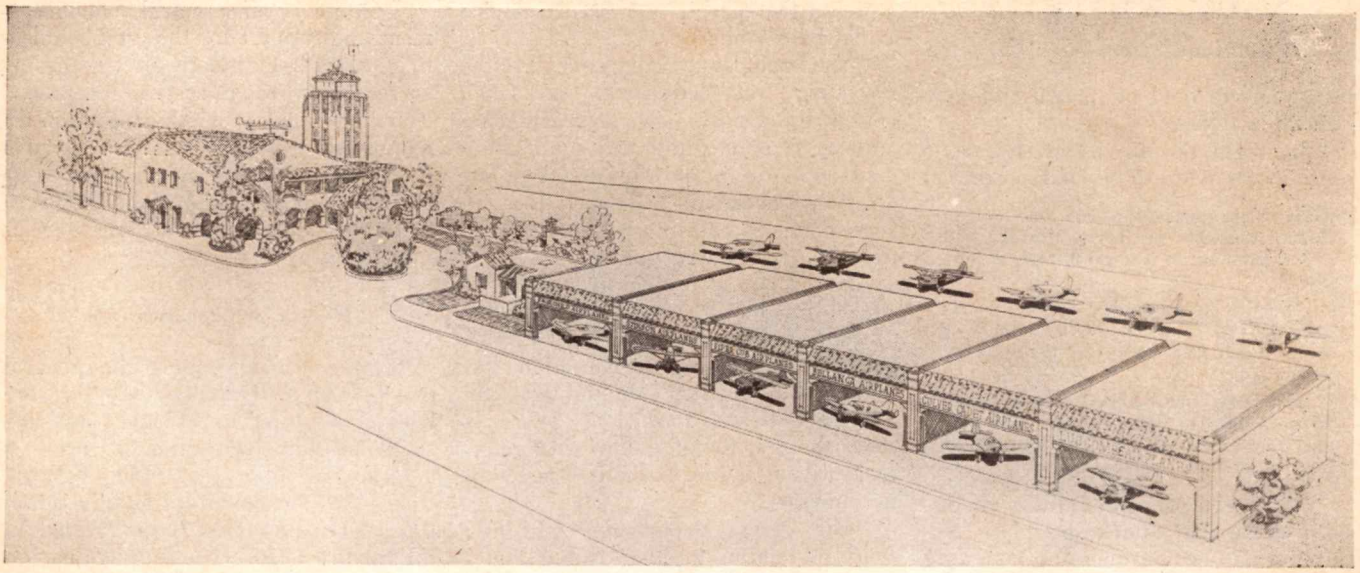
If a better argument can be found for a Department of National Defense than the arrogance of the Navy General Board in matters pertaining to air defense, this writer does not know where to find it.

Admiral Dewey, in 1913, made a recommendation for an Air Department "suited to the needs of the Navy in war" and from that date until the present, every obstacle that could be found to retard the growth of adequate air defense has been used by those in control of the Navy program.

With a merging of the Services, this condition would not exist. A project that any branch of the services failed to perform would undoubtedly be taken away and placed in other hands. We may have the cure here, for this Naval lethargy: Give the Army Air Forces a lighter-than-air project, and then watch the Navy get going! —*F.A.T.*

George T. Christopher, left, Packard president, watches final adjustments made to last of Packard-built Rolls-Royce aircraft engines to come off production line





"Airplane row" at airport, visualized as having all showrooms adjacent and facing the highway to attract more prospects by mass display

"Airplane Row" for Volume Sales

H. W. HITCHCOCK

Asst. Sales Manager, Grand Central Airport Co.

EVERY city has its "automobile row." Location of dealers in all makes of cars adjacent to one another has long been accepted as the most satisfactory way of selling automobiles, both from the dealers' and the customers' points of view. Why not, then, have an "airplane row" where the customer can inspect each make of personal aircraft and select the one that most appeals to him? Basically, there is little difference between selling airplanes and selling automobiles.

On this reasoning, we are planning what we believe is the country's first "airplane row," on Grand Central airport. Sketches on this page represent the idea in the planning stage. We, who happen to be *Ercoupe* distributors, will sell *Ercoupes* in one salesroom; dealers for each of several other makes will occupy adjoining rooms.

The initial building is designed to front on Air Way, the street on which the airport borders. The back opens onto the flying field. Rooms will be large enough to accommodate an airplane on display, with the back opening wide so that the plane can be rolled out and flown for demonstration. In addition, each unit will contain offices and a customers' lounge.

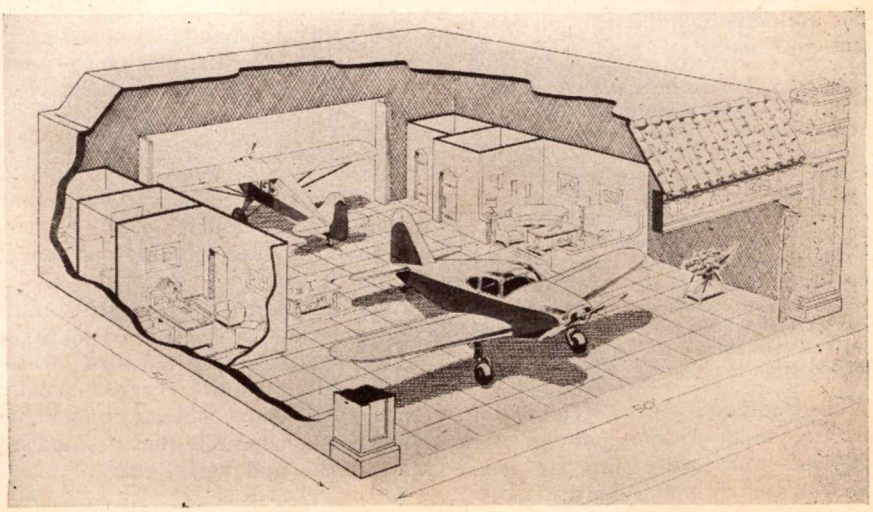
The location selected is adjacent to the airport's main passenger terminal and administration building. Visitors to the field will thus be "exposed" to the idea of buying a plane of their own and the casual looker will be indoctrinated with features of the various airplanes which may eventually turn him into a purchaser. Similarly, owners of private aircraft who come into the field will view the newer models and different makes and, like the motorist, many probably will get the idea of trading in the old crate on a newer airplane.

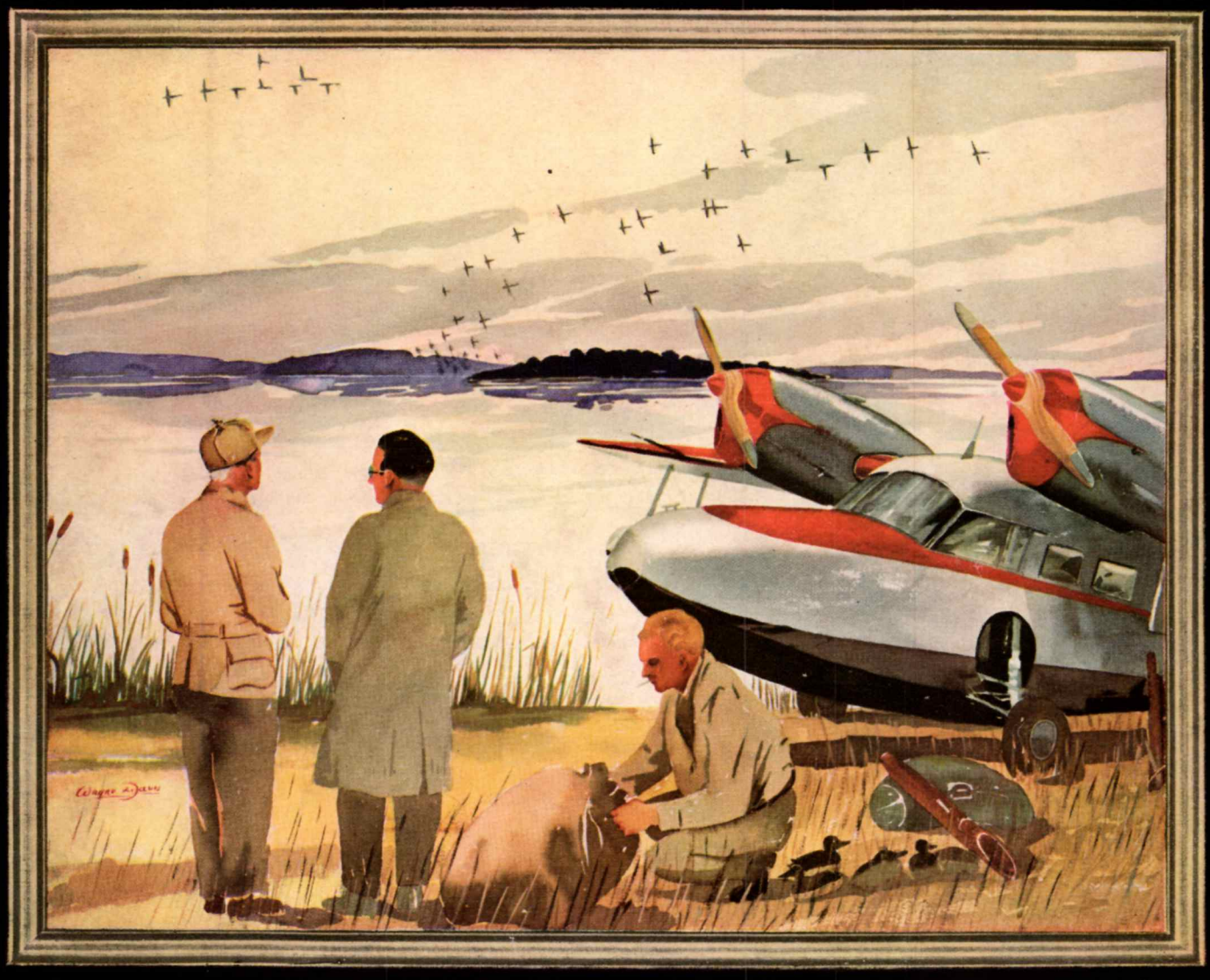
A third important group of potential customers are those owners or non-owners of airplanes who are not sufficently interested in purchasing or looking at new aircraft at the moment to run all over town looking at one make in each of several widely-scattered locations. If they can see all the latest models at one place, however, they may go and look them over. A certain proportion of those who come only out of curiosity is bound to get the idea of purchasing when they realize the appeal of aircraft.

In the immediate future, no personal airplane produced will lack for a pur-

(*Continued on page* 122)

Each dealer area would have room for plane and accessories displays, customer reception and offices. Large rear door would open directly onto flying field, facilitating plane handling





The Grumman Widgeon gives executives and sportsmen more complete use of limited leisure.

Available for immediate delivery.

Grumman

AIRCRAFT ENGINEERING CORPORATION, Bethpage, L. I., N. Y.

"...that this Nation SHALL NOT PERISH FROM THE EARTH"

Our highest military authorities are advocating a strong postwar airforce believing that the future security of America rests with air power. To make and keep that airforce strong is the obligation of research.

As one of the nation's leading designers and builders of aircraft, Curtiss-Wright is dedicating its extensive Research Laboratories to helping this nation create continued air superiority, and so keep faith with those who died that freedom might live.

CURTISS
RESEARCH LABORATORY
AIRPLANE DIVISION OF
CURTISS WRIGHT
FIRST IN FLIGHT

"ETERNAL VIGILANCE IS THE PRICE OF LIBERTY"

USE RETURN CARD FOR QUICK ACTION

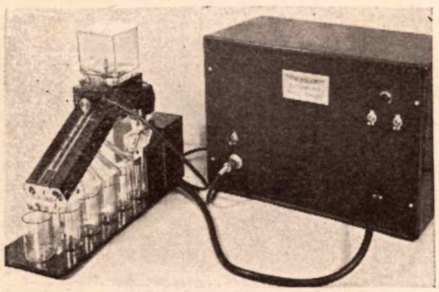
AERO EQUIPMENT Digest

AUTOMATIC BALL SORTER

AeroED 3920 (Dec. 15, 1945) . . .

To provide perfectly sized and perfectly matched balls for better and more accurate bearings, and to sort them faster, the electronics department of Jack & Heintz, Inc., developed this electronic ball gage.

When fed commercial balls, which have already been graded to a tolerance of 1/20,-



000 in, this automatic machine sorts them into groups five times more accurate. As many as ten size selections can be made—each group being separated by only ten millionths of an in.

Operation consists only in filling the *Plexiglas* hopper and removing the sorted balls. Jack & Heintz officials state that one operator can handle four machines easily, and that each four machines sort more balls than 32 skilled operators using the conventional measuring equipment—and do it far more accurately.

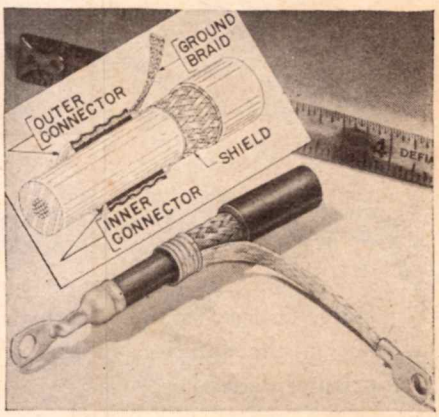
Jack & Heintz, Inc., Cleveland, Ohio

TERMINALS AND CONNECTORS FOR SHIELDED CABLE

AeroED 3921 (Dec. 15, 1945) . . .

The making of connections, taps, and splices in coaxial and shielded cable is greatly simplified by the use of connectors designed especially for the purpose by Burndy Eng'g. These connectors are new members of the *Hydent* line, which are installed by indenting with Burndy *Hytools*. Solder and the possibility of insulation being damaged by heat are eliminated.

The connector for the braided conductor or shield may be installed with a braid tap to make a terminal connection or ground tap, or it may be used merely to anchor the shield to prevent the braid from slipping. Connection with the inner conductor is made with a *Hylug* having an insulation shroud.



The lug is indented to the conductor, and the shroud crimped to the insulation to form a mechanically strong and moisture-proof terminal.

The outer conductor or shield, as the case may be, is grounded or terminated by a connection which consists of two ferrules and a braided tap which, in turn, is equipped with a Burndy *Hylug*. The smaller ferrule is slipped between the inner insulation and outer conductor, and is used to take up the pressure when the assembly is crimped. This inner ferrule is required on coaxial and other cables where the inner insulation

USE RETURN CARD FOR QUICK ACTION

3 Vital Information Services in One

For the convenience of busy executives, department heads and others whose time is valuable and who must keep themselves informed of what's new and helpful to aviation's war efforts.

1 Qualified aviation personnel may obtain additional information on the items presented in AERO EQUIPMENT DIGEST by means of the attached postage-paid reply card. Please indicate items in which you are interested by inserting key number given at beginning of each description. *Be sure to fill in month and year,* in space provided on card; also address, aviation connection, etc.

2 Complete copies of TRADE LITERATURE described on pages 99 to 107 can be obtained in same manner, on same card. Be sure to use TRADE LITERATURE key numbers, so that we can identify items.

3 Use card for additional information on any products or services advertised in this issue. See Advertisers' Index on page 150. Use Reference Numbers to identify advertisements.

USAC Hangar Service Offers You

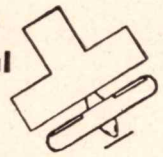
plus a Source of Income for YOU

Here, at last, is the practical, profitable answer to your hangar needs—the solution to the acute shortage of storage space for private planes.

USAC provides you with individual "T"-type pre-fabricated metal hangars, at any airport in the United States — *absolutely without obligation to you!* Each hangar, which is fully insured, is brought to you and erected by USAC *at no cost.*

You are asked to charge a nominal standard monthly rental fee—at popular low rates to plane owners. You receive a substantial percentage of the income thus derived for a period of six years. At the end of that time, the hangars—and all rent received from then on—become *yours!*

Advantages of Individual "T"-Type Hangars



- Help you overcome storage problems.
- Take up little space; easily moved from place to place; many field arrangements possible.
- Eliminate damage to planes; reduce fire hazard.
- Accommodate any size or type light plane with wingspread up to 40 ft.
- Provide ample room for tool storage.
- Popular low rental rates to plane owners.

To solve your storage problems—and make money besides—it's wise to investigate this practical, income-producing USAC Hangar Service Plan. For complete details, write to:

U. S. Aeroplane Carriers, Inc.

"FIRST IN AEROPLANE CARRIER SERVICE"

Little Creek Road Dover, Delaware Phones: 5545, 2987

Authorized by I. C. C. Member American Trucking Ass'n.

is of the type that flows under pressure.

The larger ferrule is large enough to accommodate a braid-jumper tap, and is slipped over the outer conductor or shield. The whole assembly is then crimped with interlocking dies. These dies are made to fit a foot-operated Burndy *Hytool*, Type YIOR.

Splices are made in a similar manner. A Burndy *Hylink* is used for connecting the two ends of the inner conductors. The braided conductors are spliced by a tubular connectors crimped over the two ends, ferrules again being placed under the braid to take up pressure and protect the inner insulation.

Burndy Eng'g. Co., 107 Bruckner Blvd., New York 54, N. Y.

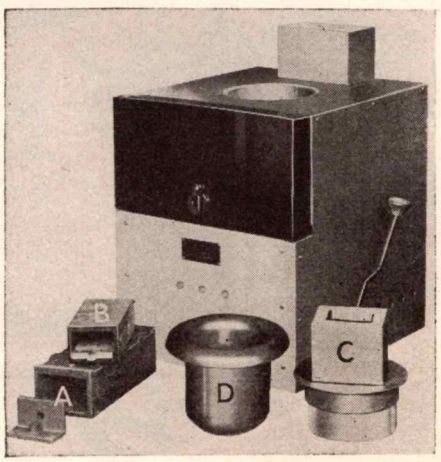
"THREE-WAY" BENCH FURNACE

AeroED 3922 (Dec. 15, 1945) . . .

Designed to fulfill the requirements of a wide variety of applications, a "three-way" bench type universal laboratory furnace is now available from Surface Combustion Corp. Controlled operation over a wide range of temperatures further enlarges its field of use.

The furnace combines three different types of furnaces in one casing. It may be used as a direct-fired over unit at temperatures from 300° F to 2400° F. For direct heating, a muffle can be placed on the hearth. If an atmosphere is desired, a diamond block can be used in the muffle. A removable plug built into the arch of the furnace provides a means of inserting a pot.

This laboratory furnace is ideal for small shops or laboratories where a wide variety



of heat treatments in relatively small quantities for small parts must be performed. Such operations as annealing, carburizing, hardening, cyaniding and tempering, with or without a furnace atmosphere, can be handled by the one furnace. It functions as a direct-fired oven, indirect heated muffle, gaseous atmosphere, salt or lead bath type and may also be used for melting soft and light metals such as tin, lead, aluminum, magnesium, etc.

The furnace is equipped with three atmosphere-type gas burners, each of which can be independently controlled. The burners are arranged under the hearth to provide uniform and rapid heating throughout the heating chamber. A gas pressure regulator

(*Continued on page* 89)

This is a reprint of a Thurston advertisement published in 1923 upon the arrival at New York of the Dirigible ZR-1.
The ZR-1 Dirigible in flight over New York yesterday equipped with Gas Cells made of cotton cloth supplied by
W. HARRIS THURSTON & CO., Inc.
We are one of the largest manufacturers of Cotton Aircraft Fabrics in America
Mechanical Cloth Specialists and producers of the finest and lightest cotton cloths
W. HARRIS THURSTON & CO., Inc.
116 FRANKLIN ST., N. Y. CITY
Telephone Franklin 1234
Rodewald

Yesterday and Today it's AIRWING!

On September 11, 1923 the Navy Dirigible ZR-1 sailed across the New York sky equipped with gas cells made of Thurston Cotton Cloth. This event marked a new, revolutionary usage of textiles by the Aviation Industry.

Thurston Fabrics and Tapes have played a major role in the amazing growth of American flying. They distinguished themselves in two World Wars and have proved dependable wherever light weight fabrics of high tensile strength are demanded.

The Airwing line includes airplane and glider fabrics, balloon and special cloths. Airwing Tapes come in a complete selection — Grade A made from long staple Pima cotton, and Lightweight — pinked edge, sealedge, biased, and pre-doped.

REG. U. S. PAT. OFF.

AIR WING FABRICS

W. HARRIS THURSTON, INC.
Division of Reeves Brothers, Inc.
40 WORTH ST., NEW YORK 13
Factory and Warehouse
17 BEACH ST., NEW YORK

ITE US FOR THE NAME OF YOUR NEAREST AIRWING TRIBUTOR

ADMA AVIATION DISTRIBUTORS AND MANUFACTURERS ASSOCIATION

MEET PURE OIL'S PRODUCTS OF THE AIR

Millions of motorists have long since learned they can be *sure* with Pure. Now private pilots are learning it too. They're meeting these fine Pure Oil fuels and lubricants at an ever-increasing number of airports throughout the 25 states of Pure Oil Land.

Pureflight Gasoline — engineered to give easy starting, maximum power for take-off, top engine performance — "tailor made" for the engines of civilian private planes.

Tiolene-Pureflight Aviation Oil — refined from fine Pennsylvania-type crude by the same process that was used in making oil for America's fighting planes.

Also: *Pureflight Low Temperature Grease... Pureflight General Purpose Grease... Tiolene Aircraft Rocker Arm Grease.*

PURE OIL'S FREE SERVICES FOR AIRPORT OPERATORS

Engineering Service — tested plans for building or enlarging ports and flight line service operations.

Merchandising Service — advertising aids for selling flight instruction, signs, giveaways, accounting forms.

Contact your local Pure Oil office or write to us.

Be sure with Pure

THE PURE OIL COMPANY, *Aviation Dept.*, CHICAGO

(*Continued from page 86*)

assures uniform control of burner operation. Fuel under low pressure without air under pressure is sufficient for burner operation, such as manufactured or natural gas, at 3- to 6-in water pressure, or butane or propane at 9- to 11-in pressure.

To assure economical application where all the features of the unit are not desired, the muffle and certain other equipment are offered as accessories. Temperature indicators are also in this category, and are available if desired.

Dimensions are as follows: hearth width and length, 6 by 12 in. Door width and height, 5¼ by 4¼ in. Over-all dimensions, width 19½ in, length 21⅝ in, height 29 in. Hours to heat from cold to 2400°F—2. Maximum gas demand 90,000 Btu per hr.

Surface Combustion Corp., Toledo 1, Ohio

SPINDLE MILLING MACHINES

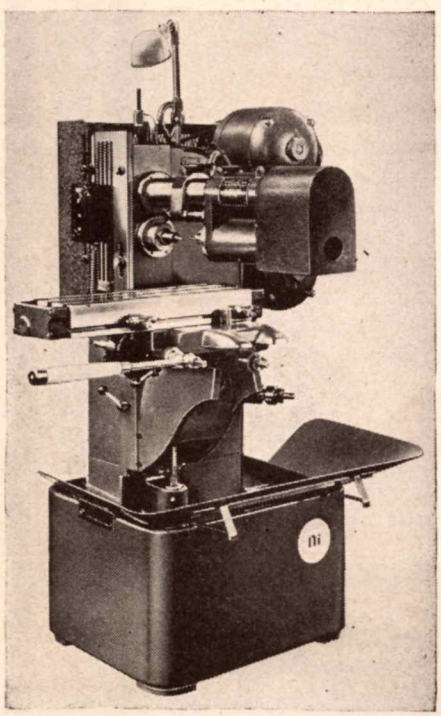
AeroED 3923 (Dec. 15, 1945) . . .

Line of double spindle milling machines for light production work requiring medium duty cuts in metals and plastics. These machines are designed so that two cuts can be made simultaneously with resultant savings in setup and production time.

The machine illustrated has two opposed spindles with No. 40 milling machine taper. Adjustments are provided on this model so that the spindles may be lined up, or may be set out of line vertically 2½ in, horizontally 2½ in, and in or out 1½ in.

Another model, not shown, can be supplied with two identical spindles, one directly over the other. A vertical adjustment is provided so that the center line of the spindles may be positioned from 4½ in minimum, to 7½ in maximum.

Both models have a choice of spindle drives. They are regularly supplied with two motors, one for each spindle, so that independent selection of spindle rotation is



BOOKS *Recently Reviewed*

Atomic Energy for Military Purposes. Henry D. Smyth. 264 pp.; index; illus. Paper, $1.25; cloth, $2.00

Wings Across the World, The Story of the Air Transport Command. Hugh Cave. 174 pp.; appendix; illus. $2.50

Principles of Radio for Operators. Ralph Atherton. 344 pp.; index; illus. $3.75

Atom Smashers. Raymond E. Yates. 177 pp.; index; illus. $2.00

Nautical Mathematics and Marine Navigation. S. A. Walling, J. C. Hill and C. J. Rees. 215 pp.; index; illus. $2.00

Thermodynamic Properties of Air. Joseph H. Keenan and Joseph Kaye. 78 pp. $2.25

Science Today and Tomorrow. Waldemar Kaempffert. 279 pp.; index. $2.75

Industrial Plastics. Herbert Simonds. 390 pp.; index; illus. $5.00

An Introduction to Electronics. Ralph G. Hudson. 97 pp.; index; illus. $3.00

The Modern Gas Turbine. R. Tom Sawyer. 216 pp.; index; illus. $4.00

Plastics, Scientific and Technological. H. Ronald Fleck. 325 pp.; index; illus. $6.50

Physics of Flight. Alfred Lande. 122 pp.; appendix and index; illus. $2.50

Aircraft Vibration and Flutter. C. R. Freberg and E. N. Kemler. 214 pp.; index. $3.00

Dictionary of Engineering and Machine Shop Terms. A. H. Sandy. 153 pp.; $2.75

Gas Turbines and Jet Propulsion for Aircraft. G. Geoffrey Smith, M.B.E. 3rd ed. 123 pp.; illus. $3.00

Introduction to Practical Radio. D. J. Tucker. 317 pp.; index; illus. $3.00

Intermediate Aerodynamics. Robert Wesley Truitt, 227 pp.; index; illus. $3.75

Engineering Preview. Linton E. Grinter, Harry N. Holmes, Henry C. Spencer, Rufus Oldenburger, Charles O. Harris, Royce G. Kloeffler, and Virgil M. Faires. 574 pp.; index; illus. $4.50

Aerodynamics. L. R. Parkinson. 107 pp.; index; illus. $2.25

Notes on Helicopter Design Theory. Alexander A. Nikolsky. 228 pp. illus. $3.00

See page 116 for AERO DIGEST book order blank

IF HE FLIES..
drives or sails..
give him a
SHERRILL
Magnetic "DIRECTOR"
COMPASS
for Christmas!
Finger-Tip Compensation!
Illuminated! Accurate!
He'll appreciate Sherrill precision and accuracy! Types and sizes for autos, boats or planes. Standard of U. S. Armed Services. Finger-tip compensation. No tools or expert help required. Beautiful molded plastic construction. Illuminated. Durable. Sold at Hardware, Drug, Chain, Department Stores, Airports, Marine and Gas Stations.
SHERRILL MAGNETIC DIRECTOR
Ideal auto compass. Illuminated. Saves tires and gas.
MARINE AND AVIATION $40.00 • FOR AUTOS $5.50
SHERRILL INSTRUMENT COMPANY, PERU, IND.

FREE

THIS NEW BOOKLET

Just off the press, this new booklet by one of the world's largest producers of accounting and control forms, gives you **all the facts** about bookkeeping and record systems necessary for profitable operation. Write today to Department 21-A.

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&
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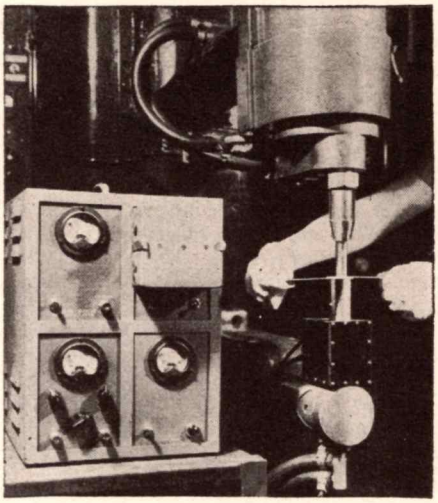
COMPANY • DAYTON 7, OHIO
Established 1866
SALES OFFICES IN
MANY PRINCIPAL CITIES

obtained. An optional drive uses a single motor which turns both spindles in the same direction.

The Nichols miller has heavy alloy spindles mounted in permanently lubricated ball bearings. The spindle nose is hardened and ground. The work table is cast of special wear-resistant alloy, with top ground to assure accurate location of standard work holders or special fixtures for semi-automatic production. The table is operated either by screw or by rack and pinion, and is fitted with graduated stops. All slides are pressure gun lubricated so that old oil is flushed out automatically each time gun is used. A quickly removable coolant tank is provided in the base.

W. H. Nichols & Sons,
48 Woerd Ave., Waltham 54, Mass.



CURRENT-FORCE RECORDER

AeroED 3924 (Dec. 15, 1945) . . .
Current-force recorder for recording current and force in resistance welding machine electrodes by General Electric Co., (GEA-4450).

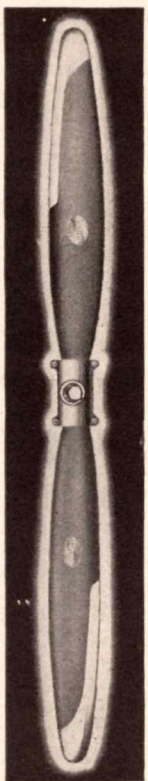
Desirable for use in welding research and for the periodic checking of welding machine performance, the recorder is specially designed to be helpful to users of energy-storage type welding machines for determining when forge pressure is applied to the work with respect to the discharge of welding current. In addition, the recorder permits resistance welding machine users to comply with Navy Specifications.

Compact, portable, and easy to use, the recorder consists of an amplifier-oscillograph unit and a special electrode holder. The amplifier-oscillograph unit, which operates from a 115-v, single-phase, 60-cycle power source, is composed of a single-channel amplifier, an oscillator, a power unit, and a small magnetic oscillograph, all housed in a sturdy metal case. This unit simulataneously records a timing wave, the rapidly changing electrode force, and the electrode current of the welding machine while a weld is being made.

The record produced by the recorder also indicates squeeze time, the duration and magnitude of the welding current, the rate of rise of forge pressure, and the hold time. The special electrode holder is equipped

(*Continued on page* 93)

It's PLASTIC-BASE Hartzite!
It's Adjustable Pitch!
It's for Light Planes!



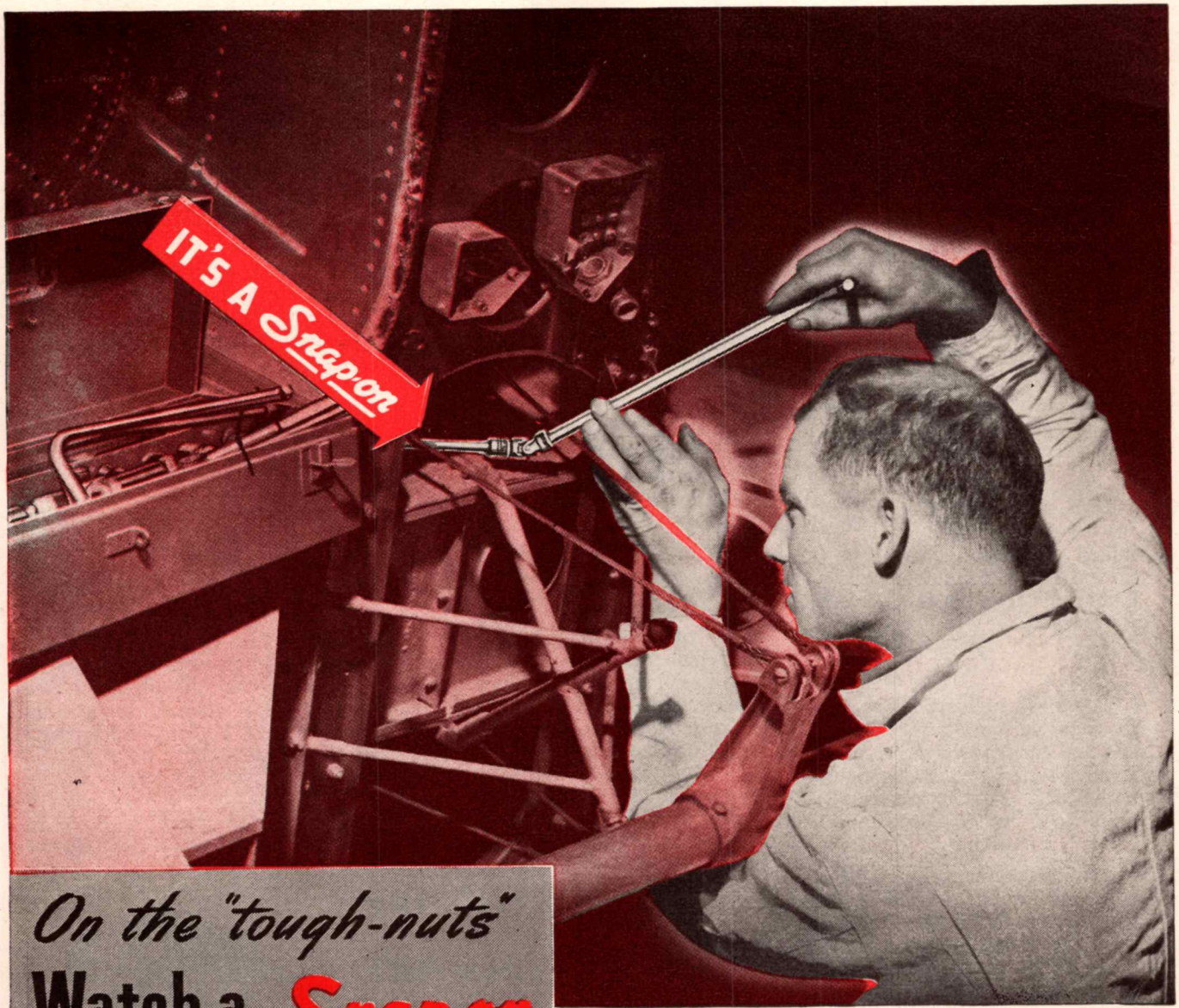
The new plastic-base Hartzite ground-adjustable propeller for light planes definitely improves performance—noticeable the instant the plane is in the air. Greater speed, better climb, greatly reduced vibration and less noise are obtained with this new propeller.

It is easily adjusted to gain just the performance wanted—economy, speed, quick take-off. It possesses very high strength with very low weight; it has very high fatigue-damage limits; it will not weather-damage. We think it's one of the great post-war developments which aviation needs for full progress.

But we have a plan which will allow you to decide for yourself. May we explain it?

WRITE FOR COMPLETE INFORMATION
OR SEE YOUR DEALER

HARTZELL PROPELLER CO.
DESIGNERS AND MAKERS OF AIRPLANE PROPELLERS AND ENGINE TEST CLUBS
470 HEITZMAN AVE., PIQUA, OHIO, U. S. A.



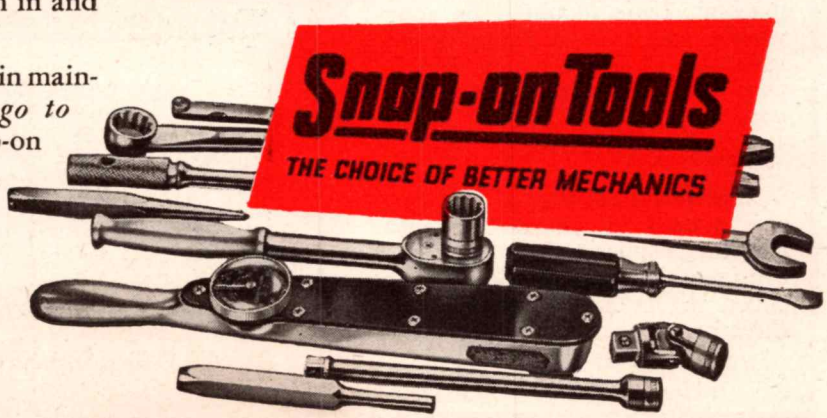
On the "tough-nuts" Watch a Snap-on Go to Work!

In the sleekly streamlined structure of a modern plane, *tough nuts* are plentiful. Blocked, hidden, fox-holed in sharply restricted spaces, they defy ordinary wrenches to "reach in and do a job".

Along aviations' assembly lines and in maintenance shops, *watch the Snap-ons go to work!* Slim, flexible, dexterous, Snap-on "combinations" by-pass obstructions, slip into tight and tricky places, grip hidden nuts securely, turn them swiftly, solidly and *safely.*

Because they speed the toughest nut turning job, and because their versatility frequently eliminates the need for specially designed one-job tools, Snap-on wrenches have earned preference in every branch of aviation. Write today for 1945 catalog of 3,000 Snap-on tools for production, assembly and maintenance.

SNAP-ON TOOLS CORPORATION
8022-L 28th AVENUE KENOSHA, WISCONSIN



The CONE AUTOMATIC MACHINE COMPANY *sees many* GOOD THINGS AHEAD

It is reported that . . . . . .

A technical magazine states that the war-developed arc-oxygen electrode will cut quarter-inch steel plate at the rate of a foot per second while under 40 feet of water. *Metal and Thermit Corp.*

get ready with CONE for tomorrow

It is estimated that within a few years 80% of the coal mined underground will be removed from the mines on conveyor belts instead of in cars. *Scientific American.*

get ready with CONE for tomorrow

The PV-3 helicopter has a long fuselage with a rotor on each end and carries twelve persons. It is being tested by the Coast Guard and Navy. *Popular Science.*

get ready with CONE for tomorrow

A new cement, for use in concrete flooring, is said to drive away insects, kill bacteria, and prevent the formation of molds. It also dissipates static electricity. *H. H. Robertson Co., Pittsburgh.*

get ready with CONE for tomorrow

An appliance manufacturer announces an electric washing machine that can also, by the use of attachments, wash dishes, peel potatoes, churn butter, and freeze ice cream. *Hurley Machine Division Elec. Household Utilities.*

get ready with CONE for tomorrow

A new gasoline-powered lawn mower resembles a floor scrubbing machine. It is mounted on four wheels and uses a rotary knife revolving at 3,000 r.p.m. *Whirlwind Lawn Mower Corp., Milwaukee.*

get ready with CONE for tomorrow

The manufacturer of the jet engine used in the P-80 Shooting Star prophesies that all transcontinental planes will be jet-propelled within five years. *General Electric.*

One of the war devices that may survive to help the motorist is the tire gauge that registers on the dash, developed for the Army's amphibious "duck." *GMC Truck and Coach Div.*

get ready with CONE for tomorrow

A magnetic survey of the state of Florida shows large areas in the southern part that are favorable for the occurrence of petroleum. *U. S. Dept. of Mines.*

get ready with CONE for tomorrow

Meals are being served in the Naval Air Transport Service that are pre-cooked, packed in a covered paper plate and frozen. On the plane they are thawed and heated in a special oven. *Maxon Sky Plate, W. L. Maxon Corp., 460 W. 34th St., New York.*

Air conditioned trolley cars are being introduced in a Southern city. This is said to be the first use of such equipment in city vehicle transportation. *Atlanta, Ga.-Pullman-Standard.*

get ready with CONE for tomorrow

A new household electric light switch can be set for delayed action up to three minutes. *T. J. Mudon Co., 1240 Merchandise Mart, Chicago.*

get ready with CONE for tomorrow

Rubber V-belts molded around a steel cable have been developed to replace chain drive on Army motorcycles. *Goodyear, Akron 16, Ohio, Whizzer Motor Co., Los Angeles.*

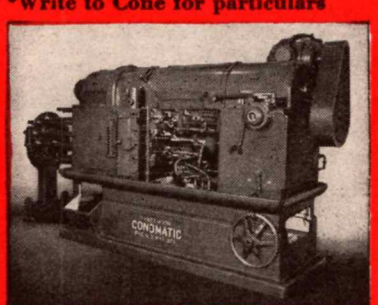
get ready with CONE for tomorrow

Even the common wire nail has been improved. The new type has a notch in place of the point and is claimed to be non-splitting. *E. S. Gair, Snyder, New York, inventor.*

15 *operations in 12 seconds*

The 15 operations that form this washing-machine part of B-1112 steel, including rolling the oil groove* in the outside diameter, are performed by the 8-Spindle Conomatic in 12 seconds.

***Write to Cone for particulars**



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

24

(*Continued from page* 90)
with strain gages for measuring compressive strain, which is a measure of the force in the electrode, and a built-in shunt for diverting from the electrode a proportional amount of current, which is used to operate an oscillograph galvanometer.

In operation, a 5000-cycle voltage from the oscillator is applied to two points on the strain gage bridge circuit, and the output from the two opposite points is a measure of the force on the electrode. The output of the bridge is fed into the amplifier, which amplifies the modulated carrier and rectifies and filters the amplified output. The output is then fed to the oscillograph, where the record is made. The welding current and 60-cycle timing wave are recorded simultaneously on the 3½-in paper record.

General Electric Co., Schenectady, N. Y.

WATERPROOF BOX AND WATER-TIGHT CONNECTOR

AeroED 3925 (Dec. 15, 1945) . . .

This box and connector have been designed to house electrical units without danger of harm by moisture. This is a hazard that has been brought home to all of us by aircraft experience in the various war theaters—especially the tropics.

The welding of corner posts into the box permits mounting screws and cover screws to be used in the conventional manner, yet not enter the main cavity of the box. Box and contents are sealed by means of a gasket in the cover. Inasmuch as the open wiring electrical connectors now generally in use are not adaptable to moistureproofing, it has been necessary to design a watertight connector.

Union Aircraft Products Corp., 245 E. 23rd St., New York 10, N. Y.

WEATHERHEAD T-RING PACKING

AeroED 3926 (Dec. 15, 1945) . . .

Weatherhead T-Ring packings afford a positive seal without leakage throughout the entire range of pressures now being used in hydraulic systems and offer many advantages.

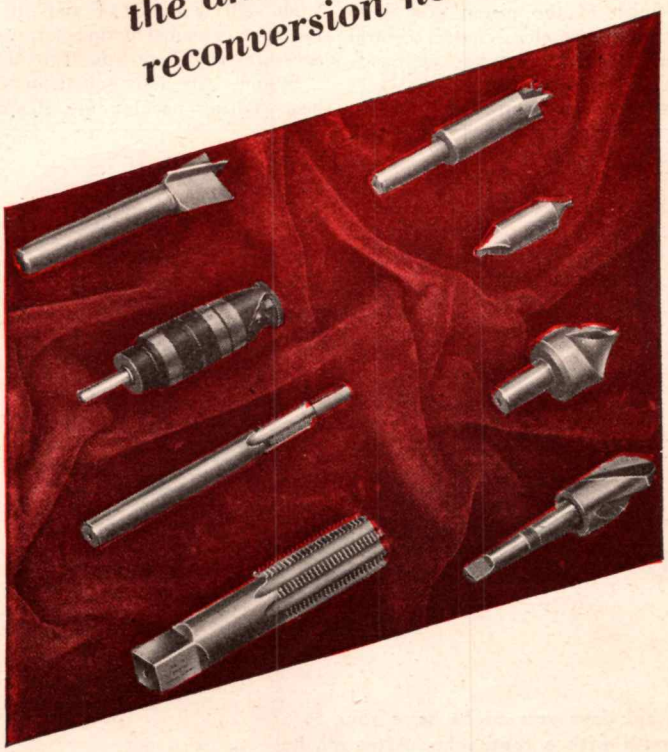
A complete cylinder, incorporating the Weatherhead type of packing, can be assembled by hand without special tools. Packing allows wider clearances between piston and bore than any other common commercial packing, thus allowing greater tolerances and a reduction in manufacturing costs. Inherent in the packing is the provision for guarding against extrusion, wedging, or pinching off of the resilient sealing member.

Application of pressure automatically centers pistons, rods, etc., and, provided sufficient clearances are allowed in the initial design, prevents scuffing or wear of adjacent parts. Even with very close tolerances, such as required in installations having high side loads, rubbing and wear are kept to an absolute minimum by the self-centering action. The Weatherhead seal as applied to end caps on cylinder barrels allows for ready adjustment of piston stroke.

In addition to the feature of ease of assembly, no gaskets or other parts are dam-

CUTTING TOOLS OF CHARACTER . . .

the answer to your reconversion needs



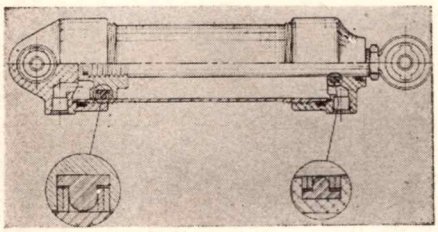
SCHRILLO TOOLS solved many a complex war production problem—provided quality so deeply inbuilt that even continuous punishment in no way impaired their accuracy and efficiency.

These same tools, by the same workman, built to the same high Schrillo standard, can today solve many a complex reconversion problem. It's worth while talking it over with a Schrillo Representative.

Schrillo Aero Tool Engineering Company, 8715 Melrose Avenue, Los Angeles 46, Calif.

SCHRILLO

LOS ANGELES CALIFORNIA



aged either during assembly or disassembly so that repair and servicing will not require a stock of new gaskets such as are required on many present designs. Diametric variations and finish of the piston groove do not require nearly the close contact control that is demanded of other types, giving T-Ring packing an extra safety feature.

Fundamental design features of the Weatherhead T-Ring packing are simple. The sealing ring is formed of resilient synthetic rubber in a T section backed up on each side by two non-extrusion ring retainers or guards. These non-extrusion rings are split and made of a laminated phenolic resin. They eliminate the effective clearance space, thus preventing the soft sealing material from being forced into the clearance between the mating parts of a hydraulic unit.

Packing is supplied in two styles, external or piston-type seal and internal or rod type seal. These packings may be used in systems where the temperature range is from —70° F to 250° F and will not leak or fail over extended periods of operation with pressures anywhere from 0 to 3000 psi.

Systems especially suited for the Weatherhead T-Ring packing are shock absorbers, control valves, actuating cylinders, wheel brake cylinders and swivel fittings. Postwar applications include industrial applications such as plastic die casting, pressure cooking utensils, machine tool hydraulic presses. This design also serves agriculture, automotive, mining, marine, railroad and other fields.

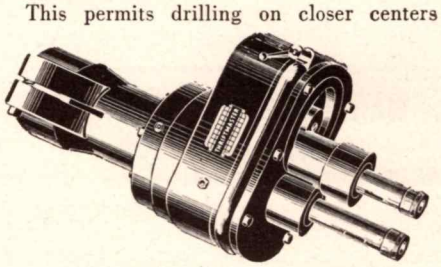
Weatherhead Co., 300 E. 131st St.,
Cleveland 8, Ohio

OFFSET-TYPE ADJUSTABLE DRILLHEAD

AeroED 3927 (Dec. 15, 1945) . . .

2-spindle offset-type drillhead in which one spindle is built integral with the drive shaft and the other is offset and adjustable for variable centers.

This permits drilling on closer centers



than is possible with the conventional type in which both spindles are adjustable. The three most popular sizes have spindles provided with ¼-in capacity chucks. No. 1 or No. 2 Morse taper, and are available from standard designs. This drillhead is of full ball-bearing construction, having all vital parts completely enclosed running in grease.

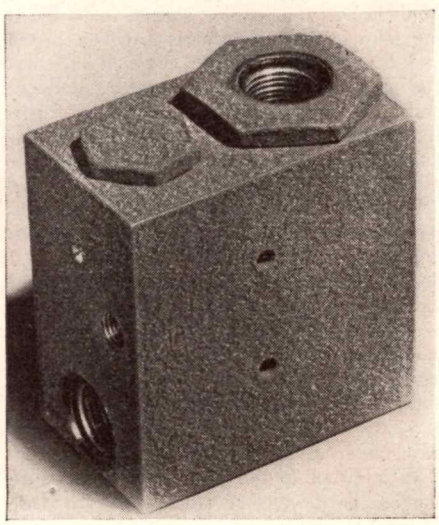
Thriftmaster Products Div.,
Thomson Industries, Inc.,
29-05 Review Ave., Long Island City, N. Y.

3-RANGE HYDRAULIC PRESSURE REGULATOR

AeroED 3928 (Dec. 15, 1945) . . .

Designed to fill an urgent need, Air Associates' 3-range hydraulic pressure regulator now makes it possible for manufacturers to use one size valve to meet the pressure requirements of 1000, 1500, and 3000-lb systems.

Smaller and lighter than conventional types, this valve is capable of adjustment without disassembly, even with the unit in



In the old days you *might* have gone to a blacksmith with a toothache. After all, he did have the pliers.

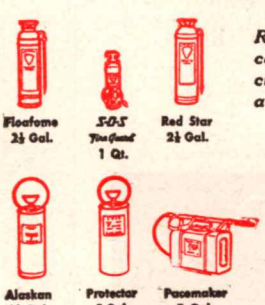
Today we ask more of a dentist. We demand that he be a specialist.

So it is with fire extinguishers. Certain types work better on certain fires. Paper and rubbish fires, for example, require an entirely different extinguisher than electrical or oil fires.

So—when you're buying fire extinguishers, buy from a firm that manufactures a complete line and can specify the *right* extinguisher for every fire hazard. Such a firm is General Detroit, specialist in "fire protectioneering" for more than 40 years.

IF IT'S GENERAL IT'S DEPENDABLE

RIGHT: CO2/Foy General's famous carbon dioxide extinguisher, is especially suited for fighting oil, gasoline, and electrical fires. Write for details.



THE GENERAL DETROIT CORP.
2270 E. JEFFERSON AVE., DETROIT 7, MICH.
Distributors in principal cities
CHICAGO DALLAS NEW YORK
West Coast Affiliate: The General Pacific Corp.
Seattle • LOS ANGELES • San Francisco

Let a General Fire Protectioneer prescribe the *right* extinguisher for your every fire hazard.

operation. A port arrangement permits hydraulic line tubing to lie flat in one plane, eliminating sharp bends which cause faulty hydraulic flow or even failure, and the straight line flow also results in unusually low pressure drop.

All parts are interchangeable. No special assemblies are required. The capacity of the regulator is 16 gpm with ½-in lines, and the regulator operates with accumulator volume as low as 35 cu in. A special drain port overcomes the effects of back pressure and tests have indicated satisfactory performance with back pressures up to 85% of cut-out pressure.

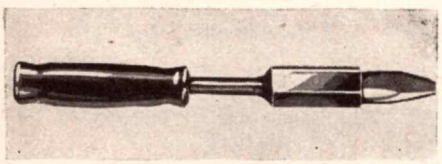
In addition to the advantages it brings to the aircraft designer and manufacturer, this valve is especially suited to test stand use where pressure requirements vary.

Air Associates, Inc.
Teterboro, N. J.

SOLDERING IRONS FOR BATTERY USE

AeroED 3929 (Dec. 15, 1945) . . .

Hexacon irons are now available on rated orders of AA-5 or better in 100- or 200-w are available with either 6-ft or 12-ft cords,



and with the conventional plug cap or battery clips.

All Hexacon irons have such features as damage-proof, hexacon-shaped barrels (protects element from mechanical injury), and scale-resistance element cores (prolongs element life.)

Hexacon Electric Co.,
100 W. Clay Ave., Roselle Park, N. J.

PRESSURE TRANSMITTER

AeroED 3930 (Dec. 15, 1945) . . .

Pressure transmitter which makes possible for the first time the recording of pressures on any continuous balance potentiometer. This instrument simplifies many pressure transmission problems and makes possible many studies heretofore impossible.

By means of a special switching arrangement, more than one pressure can be recorded on the same instrument, which makes this transmitter particularly valuable where a large number of pressures are to be recorded simultaneously.

Installation of the pressure transmitter is unusually simple, involving simple wiring instead of elaborate piping and its complications. Size and weight are small, and it is available for any type pipe fittings. This transmitter is usable for gases or liquids for pressures up to 1000 psi. No batteries are needed and the calibration is permanent. This pressure transmitter has a wide temperature range, and no amplification is required

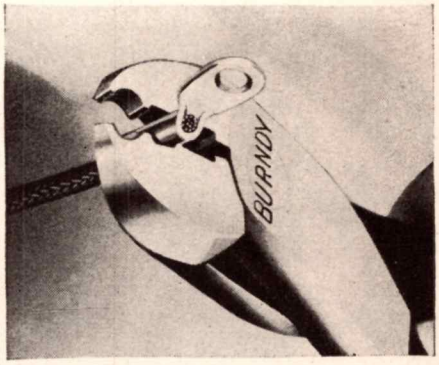
Trimount Instrument Co., 37 W. Van Buren St., Chicago 5, Ill.

HYDENT CONNECTORS FOR SMALL-SIZE ALUMINUM CABLES

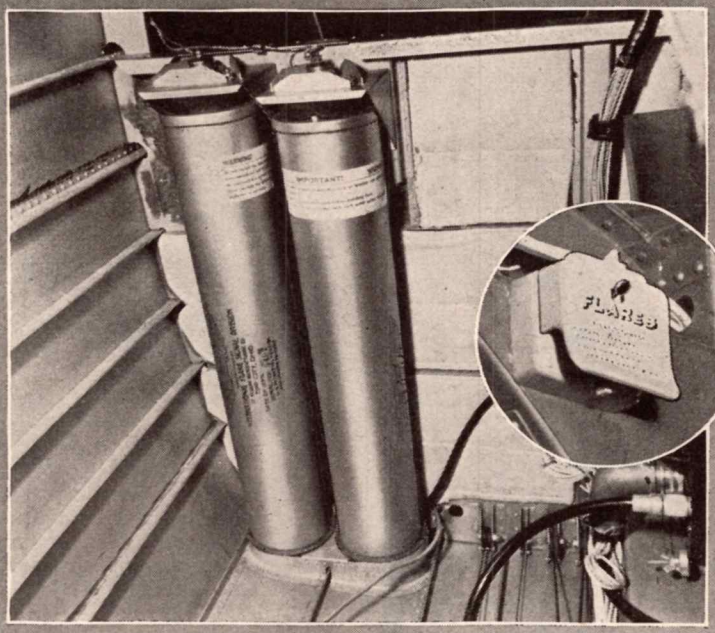
AeroED 3931 (Dec. 15, 1945) . . .

Hydent electrical connectors for small-size aluminum wires and cables which are said to provide permanent, low-resistance connections.

In the manufacture of these connectors, zinc is plated on oxide-free aluminum. This prohibits reformation of the oxide film once it has been removed, and provides the connector with a low-resistance contact surface. The barrel of each connector is then filled with petrolatum jelly in which zinc dust is suspended. Thus, when the cable end is inserted into the zinc-filled barrel, zinc compound is forced in between the individual strands. Then as the connector is indented



to the cable with the Burndy *Hytool*, the zinc particles tend to break through the oxide film on each strand as the wires are forced to rearrange themselves and wipe



SHIPSHAPE!

Pilots know that safety depends on taking every precaution. A pair of dependable INTERNATIONAL FLARES may mean the difference between a safe emergency landing and a crackup.

Shown is a typical installation of two 3-minute INTERNATIONAL PARACHUTE FLARES in a Beechcraft, Model D18S. Insert shows the electrically controlled release switch, with safety cover, mounted conveniently near instrument panel.

INTERNATIONAL offers a complete line of Parachute Flares to meet all weight classification requirements of the C.A.A.

INTERNATIONAL
FLARE-SIGNAL DIV.
of THE KILGORE MFG. CO. Tipp City, Ohio

against one another under the pressure of the indenting tool.

It is said that laboratory tests on these connections show a relative conductivity of approximately double that of an ordinary aluminum connection. For example, the ordinary connection was found to have a conductivity of 59.8% of the I.A.C. Standard, while the zinc-plated, compound-filled connection had a conductivity of 117.5%.

Aluminum *Hydent* connectors are available for the complete range of aircraft electrical conductor sizes.

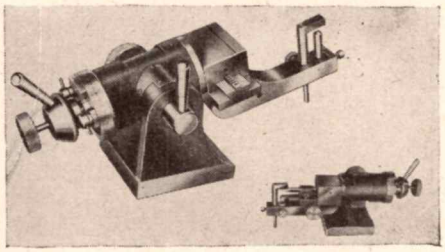
Burndy Eng'g. Co., 107 Bruckner Blvd., New York 54, N. Y.

ANGLE CORRECTING RADIUS DRESSER

AeroED 3932 (Dec. 15, 1945) . . .

Angle correcting radius dresser that provides complete wheel dressing service, including the facility for dressing an angle tangent to a radius. With this one instrument, the operator can dress (1) a radius; (2) an angle; (3) a compound-complex angle and (4) an angle tangent to a radius; in one operation.

When these four operations are performed



the primary diamond holder position is used but provision has also been made in this U. S. model for forming extremely small or large radii, in the section of the wheel in the instance where the radius has up to 180° of arc. For this work, an accessory fixture is used which consists of a special diamond holder mounted in the secondary position.

U. S. Tool & Mfg. Co., 6906 Kingsley Ave., Dearborn, Mich.

REDMER COLLET CHUCK

AeroED 3933 (Dec. 15, 1945) . . .

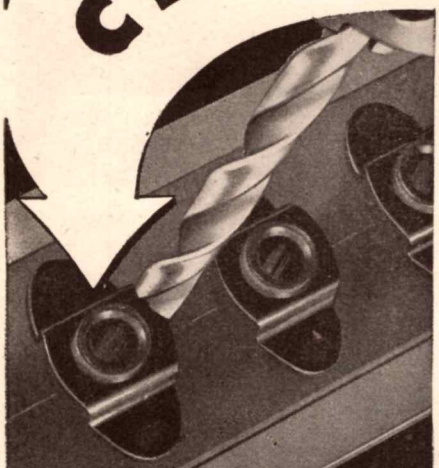
Collet air chucks of a model known as No. 4. This chuck has a collet capacity of 3½-in and uses a special type 3½-in master collet. Various size pads can be had to reduce the hole diameter to the desired size.

No. 4 chuck now allows work up to 3½ in to be held to the desired depth, as the parts can drop through the entire depth of the chuck. This is a decided advantage over the previous method whereby the depth was limited to the depth of the step of the collet.

The same principle is used as in the other four models, in that the collet remains stationary, the opening and closing controlled by the sleeve. By this method the depth of the work can be controlled even though there are variations in the diameter of the work to be held as there is no up or down movement of the collet.

Redmer Air Devices Corp., 601 W. Washington Blvd., Chicago 6, Ill.

CHECK



THE Anchor Bushing WAY

BEFORE YOU TOOL FOR PRODUCTION

- Shorten your lofting and tool making timetable by weeks.
- Permits complete tooling, whether "production" constitutes ten or ten thousand units.
- Revolutionary in scope, yet extremely simple both in principle and application.
- Check the most flexible method of precision tooling for sheet metal structures ever devised.

A description of the "Anchor Bushing Method of Apply Template Making" is yours for the asking.

Write Attention: Dept. F

* Trademark Reg. - Patent Pending

THE Avisheer RIVET TOOL CO.
1559 Sepulveda Boulevard
Hermosa Beach, Calif.

THERE'LL COME A DAY

The Armed Forces have come to town in a bigger way than ever and we're happy!

We can't accept all reservations just yet—

But sometime there'll come a day . . . and we'll be glad to accommodate you regularly again.

Thanks for your cooperation!

HOME OF THE Hawaiian Room
Hotel Lexington
CHARLES E. ROCHESTER, Vice-Pres. and Mng. Dir.
LEXINGTON AVENUE AT 48th ST., N. Y. C. 17

Yes, it's true . . . and there's a good reason why

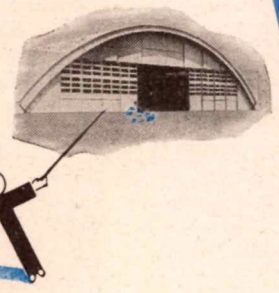
EVERYWHERE YOU LOOK YOU SEE

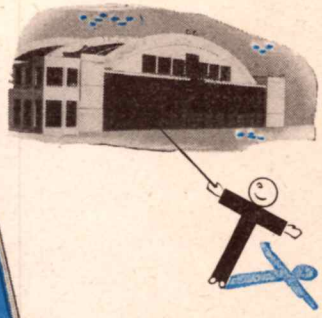
Sensenich Propellers

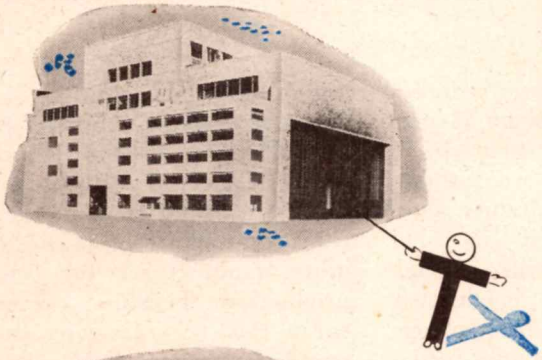
RIGHT ON THE NOSE OF SHIP AFTER SHIP
(powered under 250 HP)

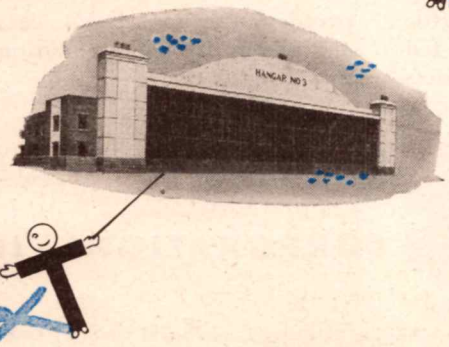
You, too, can swing a
AIRCRAFT SENSENICH PROPELLERS
Write for free list
SENSENICH BROTHERS
Adjacent to Lancaster Municipal Airport, Lancaster, Pennsylvania
West Coast Branch, Glendale, Calif.

A *New* Catalog on TRUSCON Straight-Slide Hangar Door— *now ready*









WRITE for your free copy of this new catalog today. It's packed with pictures, mechanical details and valuable reference data that tells how, when and where Truscon straight-slide hangar doors can be used to your greatest advantage.

These doors are fast-operating, smooth running and can be "tailor" made to closely meet the hangar requirements of almost every type of plane, large or small.

For details on how they can be applied to your needs—write for the new booklet, "TRUSCON STRAIGHT-SLIDE HANGAR DOORS." Experienced Truscon hangar door engineers are always at your disposal.

TRUSCON *Steel Company*

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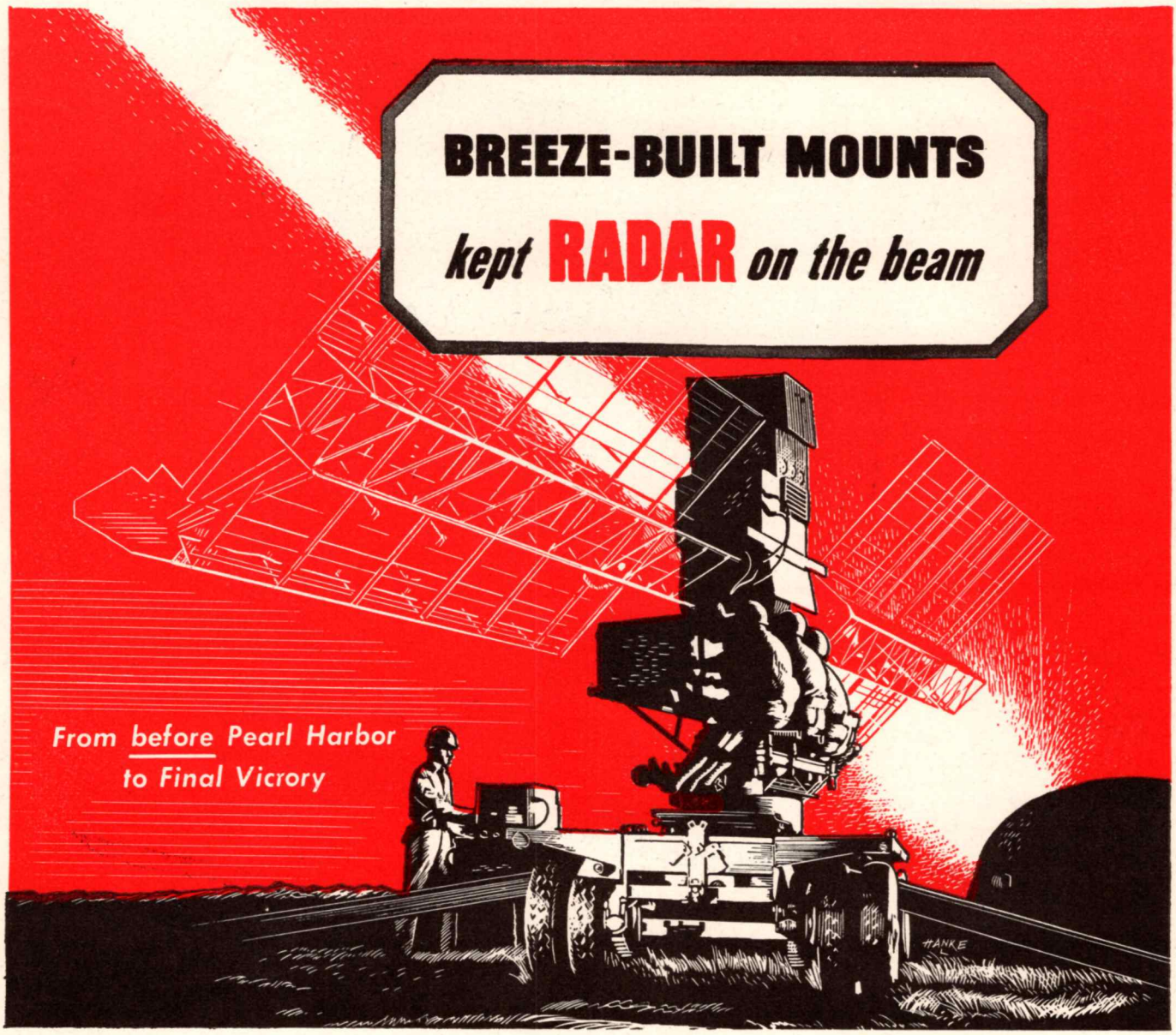


Now, for the first time, it can be told . . . the story of how Breeze built mechanical precision into electronic vision for the U.S. Signal Corps . . . to keep radar accurately beamed . . . to put guns on target . . . and to blast enemy aircraft out of the skies.

Pioneered in the late 1930's, the Breeze Mobile Antenna Mount for anti-aircraft radar was in the war from before the start to the finish. It was a Breeze-Mounted radar set that detected the Japanese sneak attack on Pearl Harbor on December 7, 1941. Rushed to England in the worst days of the war, Breeze-Mounted radar first helped to keep Hitler out of London; later reduced buzz-bomb effectiveness by 75 per cent.

Before Victory was won, thousands of Breeze-built Mounts were produced and delivered — in time and on time to every theatre of war. This production record, backed by product performance, offers further convincing evidence of the wide range of Breeze "know-how". Listed below are other Breeze products which have made the Breeze Mark the mark of dependability the world over. The diversified skills and facilities which enabled Breeze to build these precision items in huge quantities for war are now available to other manufacturers for peacetime production. Perhaps Breeze can solve that complex production problem for you. For a complete analysis and recommendation, call in a Breeze Engineer.

BREEZE

NEWARK 7, BREEZE MARK NEW JERSEY

CORPORATIONS, INC.

BREEZE PRODUCTS AND SERVICES: Radio Ignition Shielding for Radio Noise Suppression • Flexible Shielding Conduit and Fittings • Multiple Electrical Connectors • Aircraft Tab Control Systems • Internal Tie Rods • Flexible Shaft and Case Assemblies • Cartridge Engine Starters (Manufactured under Coffman patents) • Flexible Metal Tubing • Heat Treating • Metals Fabrication • Armor Plate • Bookstacks.

VITAL TRADE LITERATURE

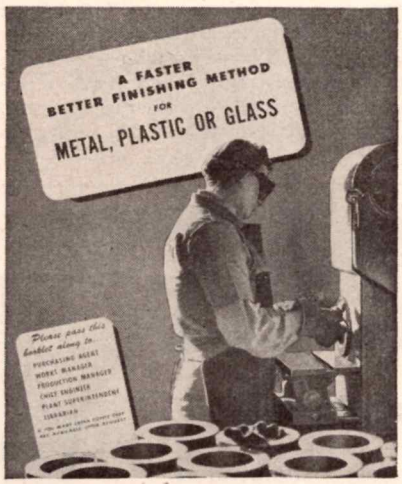
Invaluable design and manufacturing information is given in the selected trade literature mentioned on this and following pages. It is available to you for the asking—just fill out the form on page 85. The Editors suggest that you take advantage of this opportunity to secure latest data on vital subjects.

BOOKLET ON PRECISION GRINDING AND FINISHING

AeroED 3934 (Dec. 15, 1945) . . .

12-page booklet, entitled *Faster, Better Finishing of Metal, Plastic and Glass*, which describes the 3-*M Wetordry* method of precision grinding and finishing at high speeds.

The booklet explains, in non-technical language, how this modern grinding and finishing method keeps operating heat at a minimum; eliminates distortion, discoloration and plastic flow; greatly increases the life of abrasive belts; eliminates the hazard



created by dust when grinding glass, ceramics and certain metals.

An outstanding feature of this booklet are the numerous illustrations showing actual industrial applications of the 3-M *Wetordry* method to problems frequently encountered in grinding and finishing departments.

**Minnesota Mining & Mfg. Co.,
900 Fauquier Ave., St. Paul 6, Minn.**

APPRENTICE TRAINING FOR RETURNING SERVICEMEN

AeroED 3935 (Dec. 15, 1945) . . .

In reply to the thousands of inquiries from men in service for information on apprenticeship, a comprehensive booklet on the subject has been prepared especially for their guidance by Apprentice-Training Service, U. S. Dept. of Labor. This booklet, entitled *Apprentice Training for Returning Servicemen*, has been written in collaboration with representatives of the educational branches of the War and Navy Depts., and the Veterans Administration.

While the booklet is designed primarily for men still in the services, it is of equal value to those already released from service, and to employers and labor organizations, especially in gaining a clear understanding of veterans legislation as applied to ex-servicemen who are employed as apprentices.

Included in the information contained in this booklet is an explanation of the financial benefits of the veterans legislation which supplement apprentice wages, qualifications required of veterans for these benefits, as well as for apprentice training, procedure to follow, application forms and experience records needed. Among the other data presented is a list of over 100 skilled trades in which workers are trained through apprenticeship and ten major points which identify a bona fide apprenticeship program.

**Apprentice-Training Service,
U. S. Dept. of Labor,
1778 Pennsylvania Ave., N. W.,
Washington 25, D. C.**

JACK & HEINTZ ELECTRONIC GAGES

AeroED 3936 (Dec. 15, 1945) . . .

Illustrated explanatory booklet on electronic indicators, comparators, height gages and separator gages as produced by Jack & Heintz, Inc.

It is claimed that these gages have taken precision measurement out of the laboratory into the production shops. As positive as the word "electronic" implies, these precise measuring and gaging devices are offered to reduce cost of time, materials and labor in the manufacture of a wide variety of products.

The accuracy of electronic measurement is consistent. Simplicity of operation makes it foolproof when used by inexperienced workers. In addition, it gives the skilled craftsman a new sense of security; he feels that he can depend upon electronic gage readings to a degree impossible under older methods.

Electro-magnetic amplifying systems are not subject to most of the limitations inherent in mechanical systems. Jack & Heintz gages employ only high-frequency a-c, which makes possible the use of lightweight coils, generation and amplification of small amounts of current being economically provided by small electronic tubes.

Jack & Heintz gages provide a small-size gaging head to permit work in closely confined areas and there are no temperature errors, as the heat loss in the gaging head is negligible. The heat-producing elements of the system are all located in the power unit, separate from the gaging fixture, so that there can be no error due to "warming up" of the electrical units. These gages incorporate a correctly-balanced design to maintain accuracy independent of fluctuations in the ordinary supply line voltage.

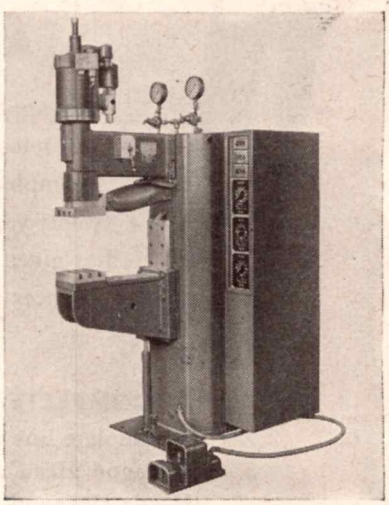
Jack & Heintz, Inc., Cleveland 1, Ohio

PROJECTION WELDER BULLETIN

AeroED 3937 (Dec. 15, 1945) . . .

Bulletin 120-A describes the advantage of forging pressure provided in a 150 KVA projection welder. The pressure sequence consists of an initial low pressure during the flow of welding current. This is sufficient to establish good contact without burning off the upper side of the projection. The pressure is also low enough to prevent a crushing of the projections which would reduce the heating efficiency of the welding current.

A forging pressure of higher value follows immediately after the passage of welding current. This quick follow-up of high electrode pressure reduces brittleness, sheet separation, and assures uniform welds with a minimum supply of power.



The addition of electrode holders easily converts the machine to a spot welder. A retraction stroke is provided which will permit a short ½-in working stroke. The machine is a self-contained unit, with electronic controls mounted in a pivoting cabinet, convenient to the operator.

The welder, type PMCO1-9, has a capacity of six projections on 0.080-in mild steel. As a spot welder: from two thicknesses of 0.032 in to 0.187 in. Throat depth is 18 in

with maximum working space between arms of 21 in. Maximum pressure is 2600 lb for 90 psi line.

Sciaky Bros., 4915 W. 67th St., Chicago 38, Ill.

PRACTICAL INFORMATION ON HAULING AIRCRAFT

AeroED 3938 (Dec. 15, 1945) . . .

Folder recently issued by U. S. Aeroplane Carriers, Inc., outlines complete scope of this company's services in the safe, economical handling and hauling of aircraft. Illustrated with loading and trailer-hauling equipment on private, commercial and military jobs, it contains information of value to manufacturers, airports and private operators.

U. S. Aeroplane Carriers, Inc., Dover, Del.

DIE CASTING BOOKLET

AeroED 3939 (Dec. 15, 1945) . . .

68-page booklet includes all up-to-date technical data based upon present knowledge and experience. Entitled *Practice in Machining Zinc Alloy Die Castings*, this booklet summarizes current machining processes on zinc alloy castings.

Methods reviewed include all those in actual use by representative die casters and tool manufacturers. The machining experience included should prove invaluable to users of die cast zinc products.

New Jersey Zinc Co., 160 Front St., New York 7, N. Y.

GRINDING AND FINISHING WITH IDLER BACKSTANDS

AeroED 3940 (Dec. 15, 1945) . . .

8-page booklet by Behr-Manning presenting complete engineering and production data on the latest methods for speeding up grinding and finishing operations by conversions from abrasive setup wheels to coated abrasive belts.

Of immediate importance to all production supervisors, tool and methods engineers and foremen, the folder permits quick appraisal of the practicability and advisability of conversion for any particular plant or operation.

Thoroughly illustrated with typical production photographs, artists' drawings and phantom views, the folder demonstrates the sound engineering simplicity of the conversion principle, gives the technical explanation of belt superiority, and presents in readily understandable form the specification range for the various types of backstands, contact wheels and coated abrasive belts.

Behr-Manning, Div. Norton Co., P. O. Drawer 808, Troy, N. Y.

STAINLESS STEEL CATALOG

AeroED 3941 (Dec. 15, 1945) . . .

96-page handbook, *Eastern Stainless Steel Sheets*, is devoted to a pictorial review of the importance of stainless steel in various industries, including transportation, architecture, food handling, hotels, and restaurants, dairies, chemical processing, laundries, textiles, photographing, hospitals, and paper manufacturing.

There is an informative section, entitled "Why Stainless Steel Resists Corrosion." At least a page is devoted to each Eastern Stainless grade of stainless, with appropriate applications of each type. Extensive data on gages, sizes, and tolerances, finishes, and a complete section of processing and fabrication are supplied. There is also an important section on "corrosion," and the catalog is completed with a fine selection of general reference tables.

Eastern Stainless Steel Corp., Baltimore 3, Md.

CATALOG SHOWING BRONZE BUSHINGS AND BARS

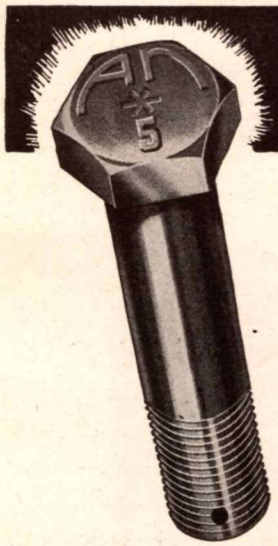
AeroED 3942 (Dec. 15, 1945) . . .

Catalog No. 45 by Shook Bronze Corp. devoted to ready-to-use bushings and machined bronze bars, made of a special phosphorized bearing bronze, for which important special advantages are claimed. These advantages include increased resistance to crushing strain, greater load-carrying capacity and improved non-seizing bearing surfaces.

This special alloy, Shook 664 phosphor bronze, is cast by a method known as radial grain control which reduces matrix size and causes the grain structure to flow toward the center of cylindrical castings from outer circumferences. Photo-micrographs show the structural superiority of bronzes cast by this method as compared to conventional means.

The catalog lists more than 800 stock sizes

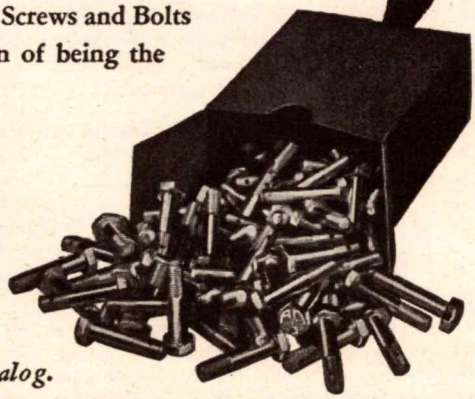
(*Continued on page* 103)



AIRCRAFT BOLTS AND SCREWS

AAF Approved Quality Control Rating

This approved rating is evidence of why so many aircraft manufacturers have selected National Lock Company Aircraft Bolts and Screws. A complete line to choose from—carefully tested and inspected. Over twenty years experience in manufacturing Aircraft Screws and Bolts has given National Lock Company the distinction of being the "Pioneer Supplier" to the Aircraft industry.



A COMPLETE RANGE OF STYLES AND SIZES

A complete line of Cadmium Plated, Centerless Ground, Hexagon Head and Clevis Aircraft Bolts, and Drilled Head Hexagon Bolts and Clevis Pins is available in a complete range of diameters and lengths.

Ask for a copy of National Lock Aircraft Bolt Catalog.

NATIONAL LOCK COMPANY

Screw and Bolt Division • ROCKFORD, ILLINOIS

BOSS..*it's a good thing*

. . . you know the company is going to need an airplane — why it will be as much a part of the business as the new warehouse. This airplane is really built. I know it is good because the company making it helped build the ships we flew in combat. Performance is a matter of record.

. . . and another thing, since I am going to do the flying, I want those twin engines and variable pitch props. And boss, look — it is equipped with two-way radio and all the instruments for blind flying — it'll be a sweetheart on the gauges, and stay right in there with airline speed and cruising radius. It'll be a cinch for you, the plant manager and your chief engineer to make those meetings, like you always wanted to — and even pick up the branch managers at Greenville and Springfield. You all arrive together and leave when you want to. It's a natural.

Okay, son, I knew it was coming. It's the way we do business, but I wanted to wait and talk it over with you. Better write SOUTHERN for details. . . it *does* look like a good thing.

Southern
AIRCRAFT CORPORATION
PLANT IN GARLAND, DALLAS COUNTY, TEXAS

Co-ordination

Co-ordinating research with manufacturing, Solar developed the above motion picture equipment to record entire welding operations under controlled conditions.

IN GOLF, complete co-ordination of skill and knowledge set the champion apart from the rest. So it is in fabricating stainless steel. This too, requires co-ordination of specialized skill and knowledge that only years of engineering, designing and fabricating can achieve.

Solar's universally recognized "know-how" in all stainless steel forming techniques, from deep drawing to precision casting, is a result of many years experience. Solar designed and built the first successful stainless steel airplane exhaust system for the Navy in 1931. And through all of the remarkable developments of the aircraft industry, including jet and gas turbine engines, Solar remains the industry's leader in producing heat and corrosion resistant products.

If your product or its parts can be built better with stainless, take advantage of this wide experience by sub-contracting this work to Solar. A letter to Solar will establish the contact.

ARMY E NAVY
ARMY E NAVY

SOLAR

HIGH TEMPERATURE ALLOY PRODUCTS

SOLAR AIRCRAFT COMPANY SAN DIEGO 12, CALIF. DES MOINES 5, IA.

(*Continued from page* 100)

of machined bushings. A variety of groove styles are illustrated and listed. Listings further include over 400 stock sizes of precision-machined bored and solid bronze bars. Suggestions for the machining and finishing of these bars are included.

Another page in the catalog is devoted to babbitt metals made by this manufacturer and supplied in silver-treated, cadmium-treated and cadmium-nickel-treated types.

Shook Bronze Corp.,
Lima, Ohio

DATA FOR CONTACT USERS

AeroED 3943 (Dec. 15, 1945) . . .

36-page electrical contact catalog and data book contains a wealth of valuable information and data for manufacturers of products utilizing contacts.

In addition to describing all of the many types of Stackpole contact materials with extensive notes on the applications of each type, the catalog gives worthwhile data on such essential factors as variables in contact selection; factors in the choice of materials; contact types, shapes, and sizes; methods of attaching contacts; contact metal compositions; welding and brazing tips; and various others.

Stackpole Carbon Co., St. Marys, Pa.

SUPERCHARGER BOOST CONTROL

AeroED 3944 (Dec. 15, 1945) . . .

Eclipse automatic boost control is described within the limitations of military restrictions. This product represents one of the Eclipse-Pioneer developments designed in collaboration with the leading engineers in the aviation industry.

Versatile in its application, it not only protects the engine from detonation or overstress but reduces pilot fatigue through automatic throttle adjustment. Eclipse-Pioneer engine control engineers will welcome your invitation to discuss your engine control or other accessory application problems.

Eclipse-Pioneer Div., Bendix Aviation Corp.,
Teterboro, N. J.

BOOKLET ON LATEX FOAM PRODUCTS

AeroED 3945 (Dec. 15, 1945) . . .

Hewitt *Restfoam* is described as genuine latex foam—made by frothing liquid latex and other ingredients under carefully controlled conditions. It is light, odorless, resilient, sanitary and long-lasting.

Restfoam is claimed to be light and airy as compared to sponge rubber because of numberless tiny air cells interconnected, so that as the body moves, the cushion or mattress literally breathes, and odors and heat are readily dissipated.

Illustrated are numerous applications of the product, found in transportation, industry, hospitals and the home. Manufacturing processes and laboratory inspections are shown and the concluding pages provide a brief history of the company and list several other well-known products it helped to pioneer.

Hewitt Rubber Corp., Buffalo, N. Y.

BOOKLET ON PERFECTED RADIO BROADCASTING

AeroED 3946 (Dec. 15, 1945) . . .

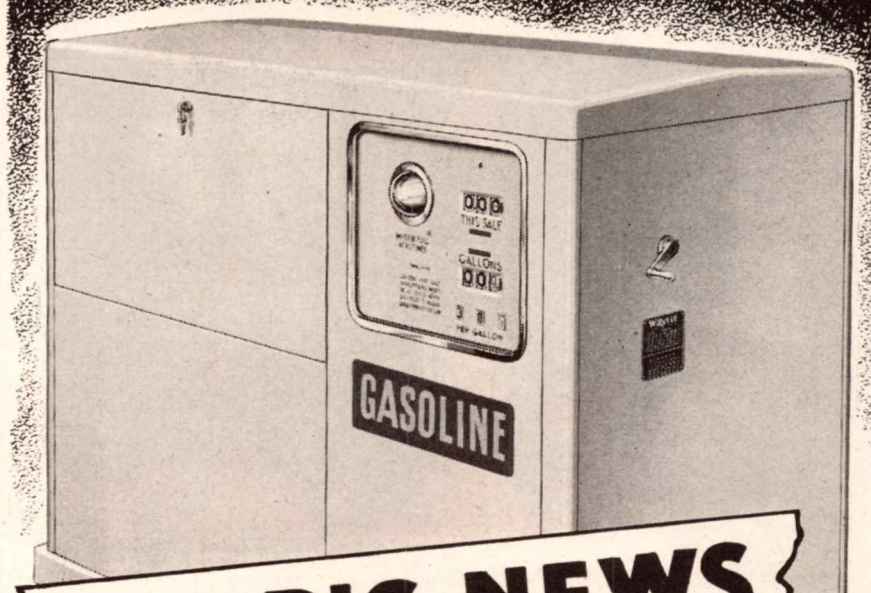
In an 8-page booklet, *The New FM Frequencies and What They Offer to You*, to be distributed to the public through distributors and representatives, the Hallicrafters Co. claims that perfected radio broadcasting may come sooner than any of the other scientific miracles promised for the post-war years.

Mention is made that every ingredient for the achievement of perfect broadcasts is now at hand; complete freedom from static and electrical disturbances of all kinds; absolute fidelity of reproduction with every overtone of the orchestra, every inflection of the singer's voice, re-created in the exact image of the original; and, finally, total victory over interference, the scrambling of programs that most listeners now accept as an inescapable accompaniment to all but the strongest of local stations.

Admittedly, this perfect broadcasting is not entirely a war-born achievement. Freedom from electrical disturbances became possible with the development of FM, first announced in 1936 by the inventor, Edwin H. Armstrong. Fidelity of reproduction has come through the steady improvement in amplifiers and loud-speakers and is made usable in radio broadcasting by the assignment of adequate channel width to individual stations.

The part Hallicrafters has been able to play in this achievement is a matter of company pride, the booklet explains. The com-

AIR COMPRESSORS · HOSE REELS · AIR SCALES · LIFTS · CAR WASHERS



THE BIG NEWS

WAYNE COMPUTING TYPES AIRCRAFT REFUELERS . . .

SELLS OIL, TOO

READY for the "age of air" just ahead . . . the Wayne Airport "service station" in a single compact, streamlined cabinet. It computes and records the sale like an automotive gasoline pump . . . incorporating the same time-tested units plus self-retrieving hose reel and many new refinements. All complete ready to install. Sells oil, too, from shelves holding three cases of quart cans. Write today for bulletin and prices.

THE WAYNE PUMP CO., FT. WAYNE 4, IND.

WAYNE *Airplane* REFUELING SYSTEMS

ROUSTABOUT CRANE

Cuts the cost of 100 load-handling jobs all around your plant....

The powerful, versatile, mobile load-hustler hundreds of users wouldn't be without

● Faster handling *at lower cost*—your need changes with war's end. You profit from the Roustabout's yard-efficiency as from indoor materials handlers. It's where you want it when you want it, prevents delays, breaks emergencies, gets action everywhere, at low cost, on bulky stuff to 7½ tons. Modernly built for years of overwork — ball-bearing boom turntable and all gears in oil. Full swing boom, smart operation, you quickly find Roustabout indispensable. Get the facts . . . write today!

Roustabout saves you time and money on these and many other jobs

- **Big stuff off and on trucks, freight cars**
- **Moving large machines and parts**
- **Handling bales, boxes, drums**
- **Moving big castings, motors, railroad and marine gear**
- **Loading air transport planes**
- **Handling tanks, pipe, structural steel, rails, timber**
- **Installing heavy valves and fittings**

ARMY E NAVY

THE HUGHES-KEENAN COMPANY
645 Newman Street, Mansfield, Ohio

ROUSTABOUT CRANE

Roustabout Cranes
By Hughes-Keenan
Load-Handling Specialists Since 1904

pany was one of the earliest builders of FM receivers, a pioneer in the development of practical equipment for the very high and ultra-high frequencies, and the only manufacturer to produce a successful commercially-built receiver covering both the old and new FM bands.

The company also has developed and successfully demonstrated comparatively inexpensive converters which make it possible tor FM receivers which do not cover the new band to tune in on the recently established frequencies. It has applied for authorization to manufacture the converters in quantity.

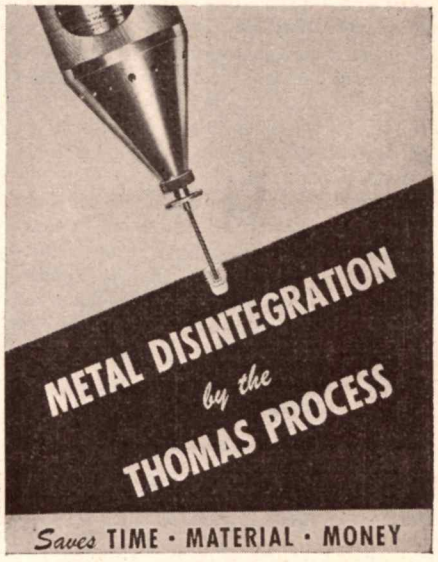
To provide a basis for better understanding of the problems involved in establishing the new FM allocations, the booklet gives the theories of radio transmission and some of the reasons why Hallicrafters considers the revision upward of the FM band logical.

Hallicrafters Co., 2611 Indiana Ave., Chicago, Ill.

METAL DISINTEGRATOR

AeroED 3947 (Dec. 15, 1945) . . .

6-page treatise on metal disintegration, titled *Metal Disintegration by the Thomas Process*, describes and explains the adaptation of a principle of electronics to the disintegration of ferrous metals, using a low-voltage, high-frequency make-and-break arc at point of contact.



It illustrates examples of metal disintegration on all types of ferrous metals, in addition to the removal of broken and embedded taps and small tools from all types of materials.

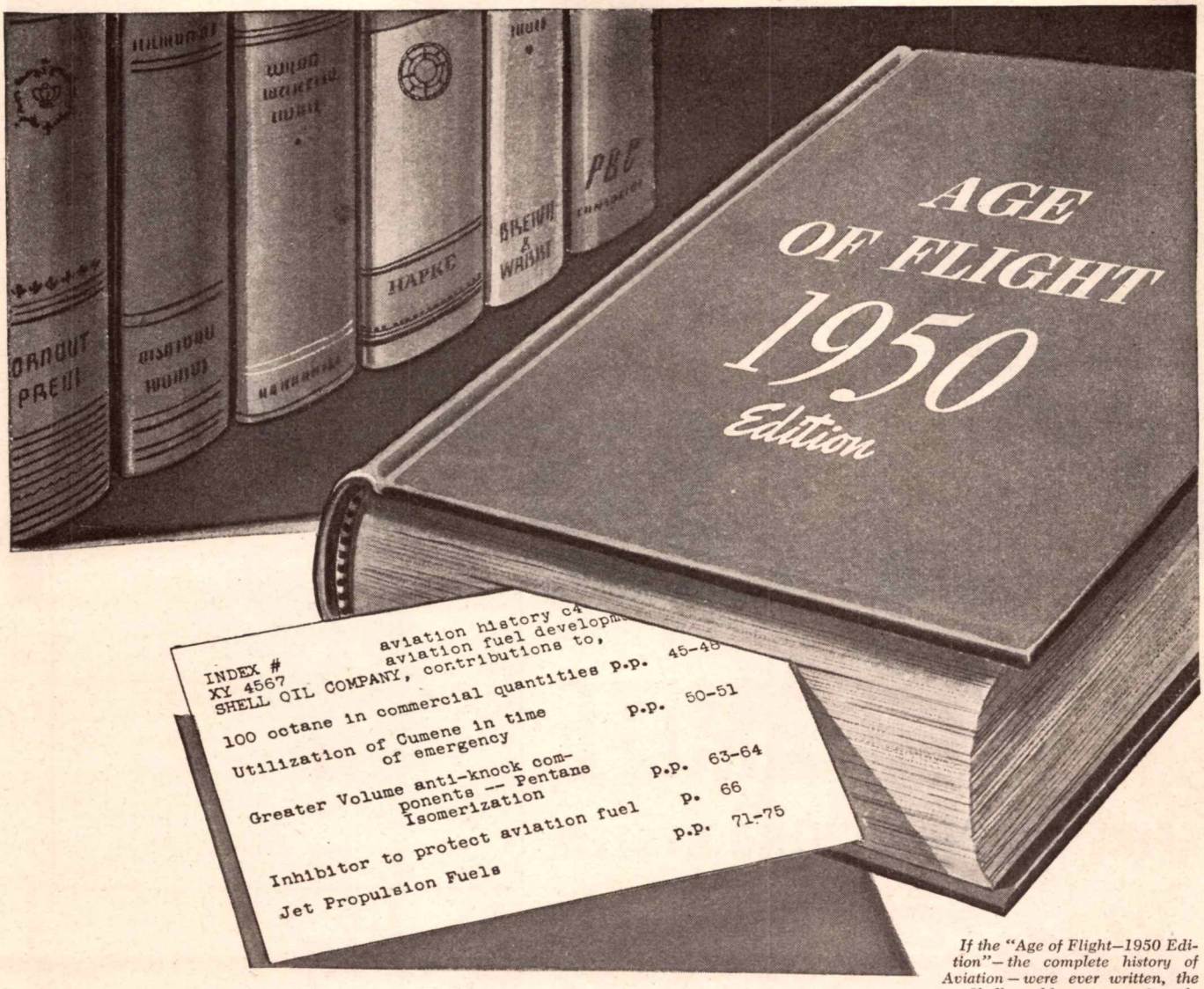
Clinton Machine Co, Clinton, Mich.

RELEASED ELECTRONIC EQUIPMENT AVAILABLE

AeroED 3948 (Dec. 15, 1945) . . .

First catalog listing electronic equipment and components released by the RFC to the Electronic Corp. of America is available to manufacturers and distributors. The Electronic Corp. of America is serving as agent for the RFC in the sale of this equipment

(*Continued on page* 107)



If the "Age of Flight—1950 Edition"—the complete history of Aviation—were ever written, the name Shell would appear consistently as a leader in Aviation Fuel development.

SHELL RESEARCH WILL HELP YOU WRITE TOMORROW'S AVIATION HISTORY

In tomorrow's textbooks on science and aviation, Shell will be closely linked with jet propulsion . . . revolutionary power source.

Shell scientists, at this very moment, are exploring the future in a laboratory devoted entirely to jet propulsion fuel and lubricants.

The time for use of these Shell-developed products, in this exciting field, keeps coming closer . . . to bring the day when giant liners will streak across the skies at speeds approaching that of sound.

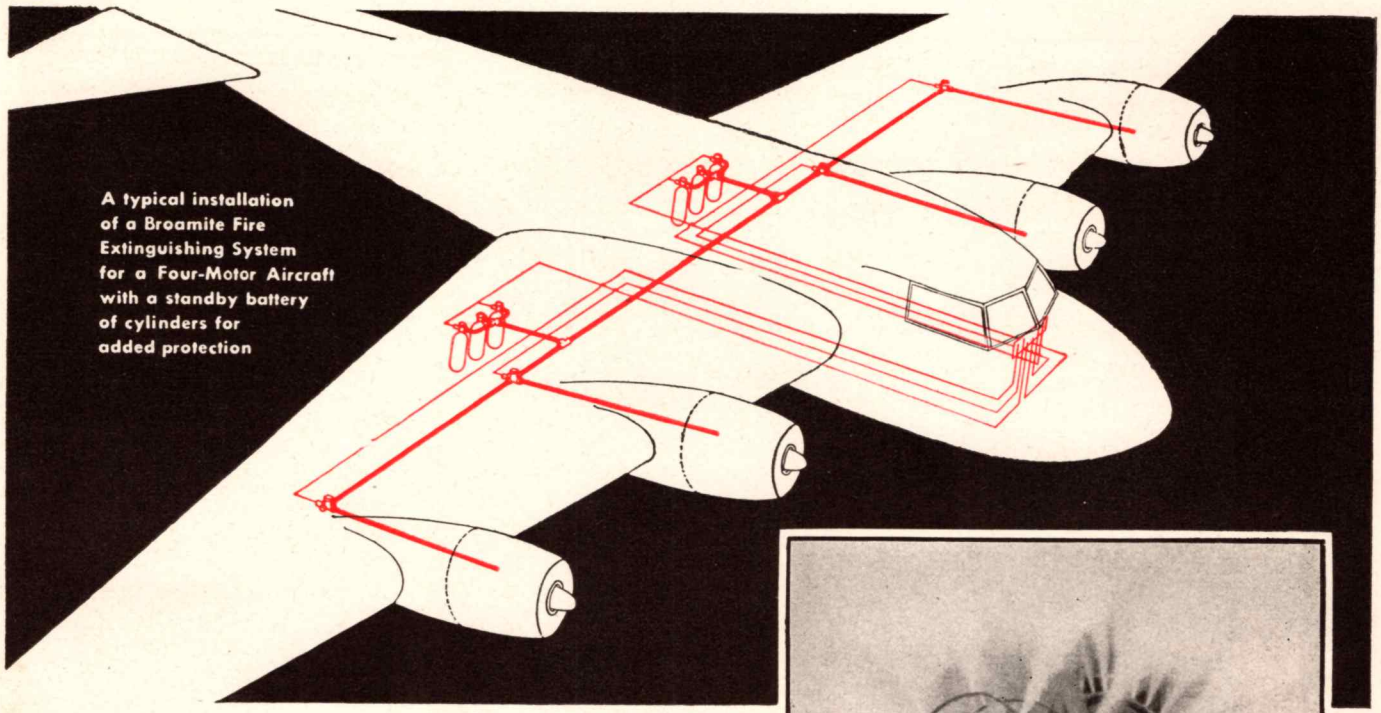
You can be sure that the research which first supplied the Army with 100-octane fuel in commercial quantities is making important progress in this new undertaking.

* * *

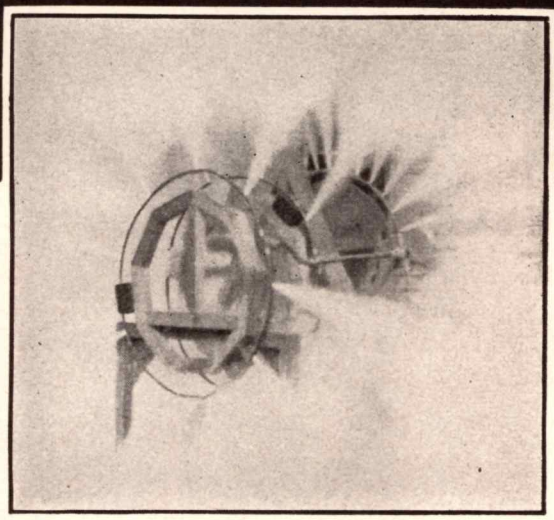
You will find this brand of advanced thinking—backed by the full force of Shell Research facilities—reflected in the quality of AeroShell lubricating oils and greases, and Shell Aviation Gasoline.

SHELL

FINER FUELS FOR THE AGE OF FLIGHT



A typical installation of a Broamite Fire Extinguishing System for a Four-Motor Aircraft with a standby battery of cylinders for added protection



New BROAMITE

FIRE EXTINGUISHING SYSTEM

Cuts Risk, Weight and Maintenance in half!

Flash of flame. Burst of Broamite. Fire's out! Altitude, temperature, speed. None has nullifying effect. Our new Broamite Fire Extinguishing System is so light, a standby battery of cylinders may be carried for extra protection, so positive the chemical always hits the vital spot, so simple, installation is easy; and so is maintenance. This aircraft fire-extinguishing system is one of the greatest achievements in our hundred years of experience.

Write for details or for a call by one of our fire-equipment engineers.

AK-1

Methyl Bromide

OUR 2nd Century of Leadership in FIRE PROTECTION

AMERICAN-LAFRANCE-FOAMITE Corporation

ELMIRA · NEW YORK

(*Continued from page* 104)

and maintains a warehouse for this purpose.

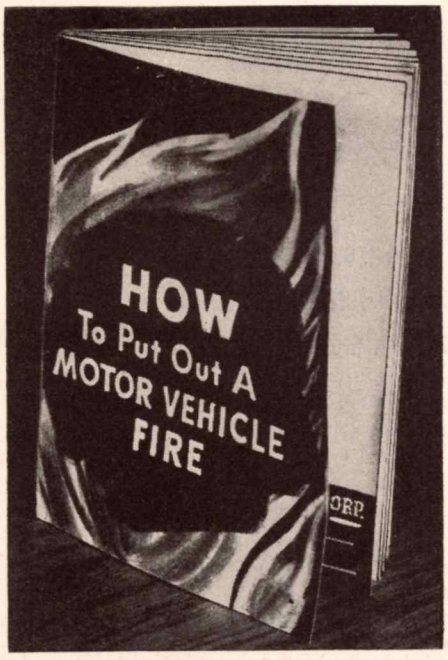
The list comprises 507 separate electronic items in varying amounts from one to several thousand of each item. Each item in the catalog is carefully described and priced and the number available accurately stated. Included among the items available are antenna wire and assemblies, coils, chokes, condensers, sockets, rheostats, generators, amplifiers, resistors, switches, transformers, microphones, wire, and telegraphic keys and other equipment. New materials are being released daily. All items are offered subject to prior sale.

Electronic Corp. of America,
45 W. 18th St., New York 11, N. Y.

FIRE FIGHTING BOOKLET

AeroED 3949 (Dec. 15, 1945) . . .

Contents of the book, *How to Put Out a Motor Vehicle Fire*, consist for the most part of simple, concise instructions on what to do when fire breaks out—how to handle ignition fires, gasoline fires, fires in the interior of the car, under the hood, and under the car itself. The book also furnishes



simple rules to follow in the prevention of motor vehicle fires. Complete I.C.C. safety regulations are likewise included.

General Detroit Corp., 2270 E. Jefferson Ave.,
Detroit 7, Mich.

ELECTRONIC BOOKLET

AeroED 3950 (Dec. 15. 1945) . . .

Profusely illustrated in cartoon technique, and simply written, a booklet, entitled *The Amazing Electron*, is intended to bring within the grasp of everyone the basic facts about electronics.

The Amazing Electron is the second in a series of consumer publications by ECA, and further booklets are now being planned. In the foreword to the present booklet the reasons for ECA interest in these consumer publications is stated to be the belief that "just as a well-informed people provide the best basis for a healthy democarcy, well-informed consumers provide the best basis for healthy business."

Electronic Corp. of America, 45 W. 18th St.,
New York 11, N. Y.

ISOTHERMAL HEAT TREATMENT

AeroED 3951 (Dec. 15, 1945) . . .

Bearing Races Improved by Isothermal Treatment cites an outstanding benefit to be derived from the treatment discussed therein—namely, that distortion was less than previously obtained in one-at-a-time oil quenching on a die-press machine. This should be of interest to all bearing, gear and bushing manufacturers as well as plants now using quench and temper treatments or where costly die-press machines must be used in order to control distortion of many heat treated metal parts.

Ajax Electric Co., Inc.,
Frankford Ave. at Delaware Ave.,
Philadelphia 23, Pa.

NON-INFLAMMABLE GASKET SEALER

AeroED 3952 (Dec. 15, 1945) . . .

Folder describing *Sumtex* MM-50, a non-inflammable gasket sealer, has been issued by Summit Paint and Varnish Co., manufacturers of the product.

Developed originally at the specific request of a large aircraft engine manufacturer, *Sumtex* MM-50 is described as non-settling, non-hardening, unaffected by oils and acids, and soluble in carbon tetrachloride, which in itself is a fire extinguisher. Tests up to 350°F and in high-pressure hydraulic systems have shown no effect on the essential characteristics of the materials.

Summit Paint & Varnish Co.,
581-89 Windsor St., Hartford, Conn.

INJECTION NOZZLE BOOKLET

AeroED 3953 (Dec. 15, 1945) . . .

12-page booklet on the Ex-Cell-O fuel injection nozzle for Diesel and gasoline engines describes the operation of the nozzle and how it works in relation to these engines. It is written so that the layman can understand it and is fully illustrated with photographs and cross-sectional drawings.

Ex-Cell-O Corp., Fuel Injection Div.,
1200 Oakman Blvd., Detroit 6, Mich.

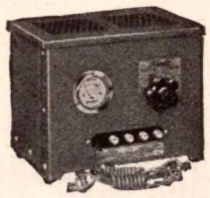
TOGGLE CLAMP BULLETIN

AeroED 3954 (Dec. 15, 1945) . . .

4-page bulletin by Mechanics Eng'g. Co. describing *Mech-Master* toggle clamps. These clamps are instantly adjustable from 22½° above horizontal to 22½° below horizontal by a quick turn of the handle. Bulletin describes several models and shows illustrations of clamps in use under varying conditions. *Mech-Masters* have numerous applications in jig and fixture work and in various kinds of repair and bench work.

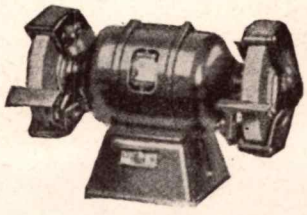
Mechanics Eng'g. Co.,
Box 243, Jackson, Mich.

BALDOR



BATTERY CHARGERS

Above, BALDOR Battery Charger No. F-12 (12-battery capacity) one of a complete line up to 24-battery capacity. Improved ventilation for cool operation, greater efficiency, long life. 2-YR. GUARANTEE. Ask for Bulletin No. 320



GRINDERS

BALDOR builds a complete line of Bench and Pedestal Shop Grinders, 6" to 12" wheels, including newly improved special grinder for Carbide Tools. Ask for Bulletin Nos. 321 & 322

BALDOR ELECTRIC CO.
4305 Duncan Ave., St. Louis 10, Mo.

You can have one—NOW!
REGULATION A-2
Army Air Force
LEATHER
Flight
Jacket
ONLY
$19.95
Ceiling Price
POSTAGE PREPAID

The same official Flight Jacket worn by America's Top Pilots, Bombardiers, Navigators and Flight Personnel. ALL-LEATHER — windproof, rainproof, light in weight but extra warm. To order, give your height and suit size. Color is Dark Brown. Send money order or check only. Money-back guarantee.

NOTE SPECIAL FEATURES!
Solid brass zipper. Pure wool cuffs & waistband.
Safety snap collar & pockets. Water repellent lining.

Send one overseas! Just get a request

PERRY SALES CO., DEPT. DEPT AD-12
37-47 82nd St., Jackson Heights, N. Y.

Enclosed is $19.95. Suit size..... Height.....

Name.....

Address.....

City.....Zone.....State.....

MAIL YOUR ORDER TODAY!

Controls Coordinated in the "Three-in-One" System

● Plans are now being formulated for the manufacture of the *Elme* 3-in-1 pilot's control unit recently announced* by Greater New York Industries.

The device, by which all three controls of an airplane can be operated by the manipulation of the control wheel, eliminates altogether the need for rudder pedals. It is not to be confused with the so-called two-control airplane, in which the rudder cables are connected with those of the ailerons in such a manner that a turn of the wheel operates rudder and aileron simultaneously and in synchronization. By use of the *Elme* control, it is possible to perform all maneuvers which can be performed by an airplane equipped with conventional controls.

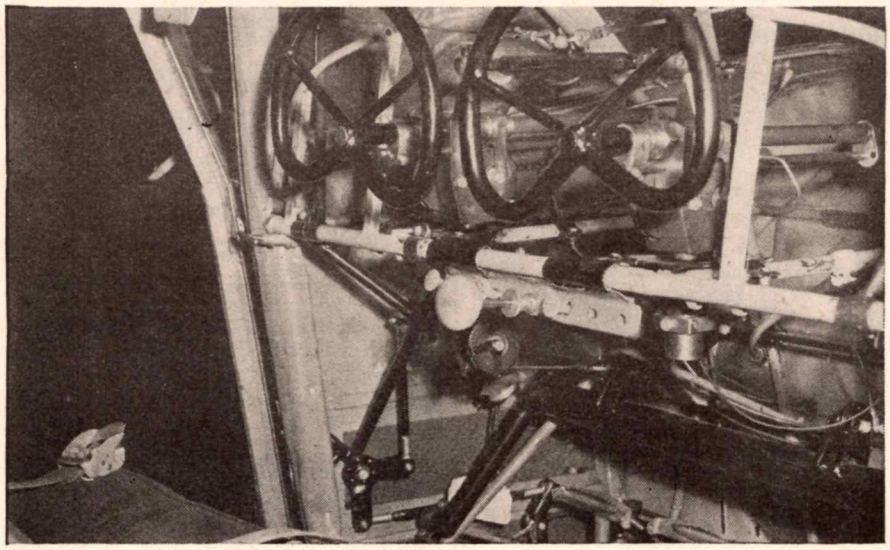
The unit can be installed in any airplane having the usual arrangement of cable or rod connections to the elevators, ailerons, and rudders.

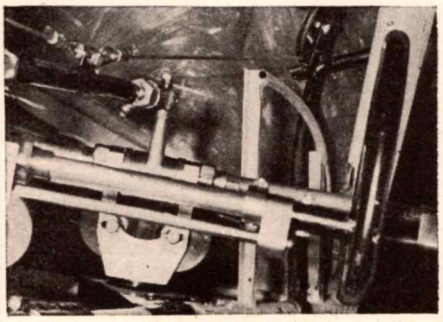
Basically, the unit is comprised of a vertical shaft, rotation of which controls the rudder, and a horizontal shaft running fore and aft. This is mounted on the vertical shaft, and controls the elevators by reciprocation — sliding fore and aft along its axis—and the ailerons by rotation. The *Elme* control permits operation of the elevators and ailerons in the same manner as with a conventional wheel, and control of the rudder by swinging the wheel in a horizontal plane.

To make a left turn, for example, the wheel is rotated to the left (counterclockwise) to operate the ailerons, and at the same time it is pushed with a swinging movement toward the pilot's right, rotating the vertical shaft and operating the rudder.

The elevators are operated in the usual manner, by a forward and aft movement of the wheel.

Principal advantage claimed for the *Elme* is that it simplifies coordination of the three controls. It is estimated, also, that it may reduce manufacturing and installation cost of the control system by 50%, and that weight savings of as much as 30% over the original conventional control system may be achieved.





Installation of "Elme" 3-in-1 control, showing horizontal shafts from centers of wheels, and linkage to ailerons

*AERO DIGEST, Oct. 15, 1945, page 101

Operated by Hand Only

The inventor has pointed to the fact that, since the unit makes it unnecessary for a pilot to use his feet in controlling an airplane, it will be possible for amputees to fly aircraft safely and easily.

The *Elme* unit, installed in a side-by-side lightplane, was flight-tested both privately and by the CAA. It has been issued a CAA demonstrational license. The plane is at present being flown on a demonstration tour to various manufacturing centers in the United States.

Fine Wires Incorporated in Anti-Icing Windshield

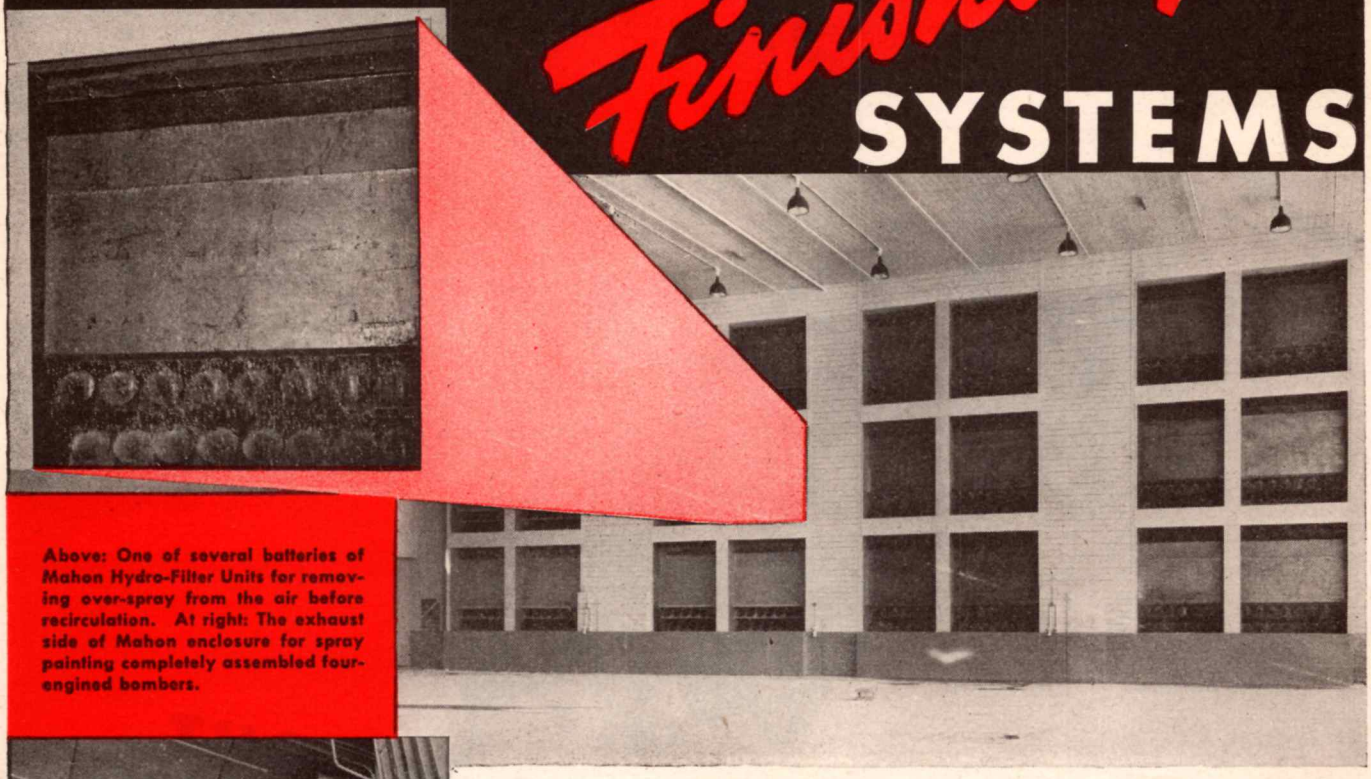
● Announcement of an improved glass sandwich airplane windshield containing nearly invisible "defroster" wires came recently from the engineering department of Lockheed Aircraft.

Combined with another product of Lockheed laboratories—the *Flex-Seal* window edge—the new development is said to be vastly superior to former experimental windshields whose imbedded resistance wires were so big as to hamper visibility through the glass. The "sandwich" was developed over a two-year period by the company's electrical research group of laboratory technicians.

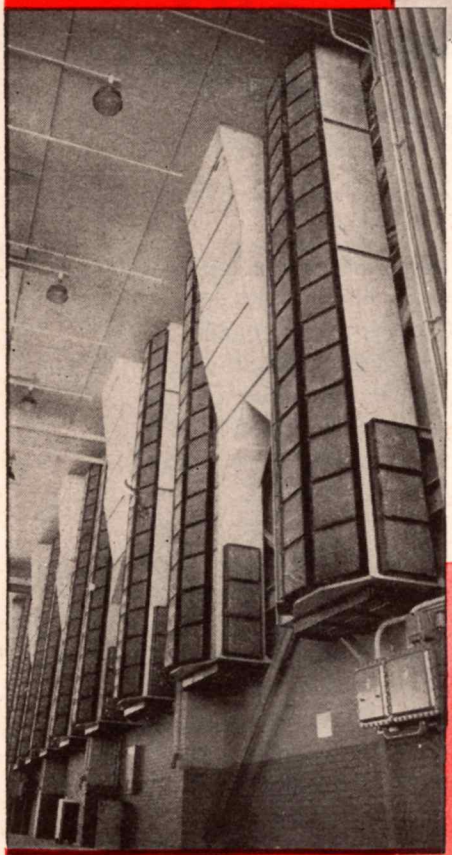
In a plane equipped with such a windshield—in which the imbedded wires are only half a thousandth of an inch in diam—a pilot should have no trouble from impeded visibility when he reaches ice-forming altitudes. A flick of a switch in the cabin will send electric current through the hair-like wires in the interface of the glass and plastic sandwich comprising the windshield. The current will make the entire window hot enough to prevent ice formation.

Manufacture of the windshields will be undertaken by Pittsburgh Plate Glass, it is reported.

AIRCRAFT *Finishing* SYSTEMS



Above: One of several batteries of Mahon Hydro-Filter Units for removing over-spray from the air before recirculation. At right: The exhaust side of Mahon enclosure for spray painting completely assembled four-engined bombers.



Above: Filtered Air Supply Units on the air supply side of Mahon enclosure for spray painting four-engined bombers. At right: Typical Mahon Finishing System for Airplane Parts and Partial Assemblies.

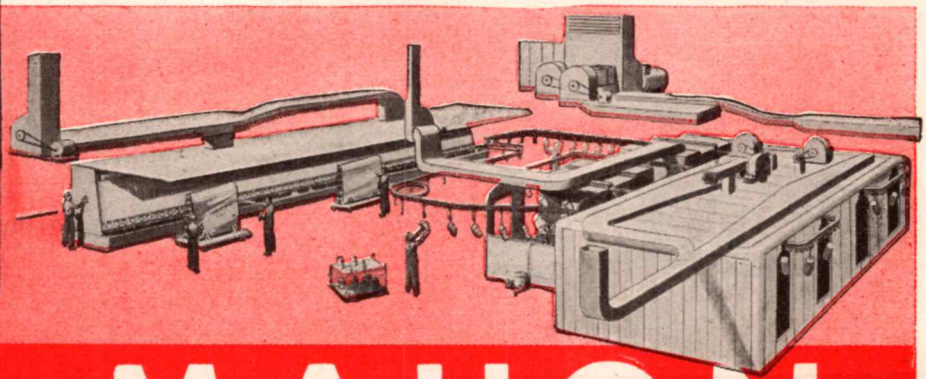
. . . for Spray Painting Completely Assembled Airplanes or Smaller Assemblies and Parts

Over twenty-five years of experience in every industry where Spray Painting is an important production operation, has endowed the Mahon organization with a wealth of technical knowledge and "know how" which is responsible for the outstanding success of Mahon Finishing Systems all over the world. Mahon engineers are prepared to analyze your Finishing problem and engineer, build, and install a complete Finishing System which will meet your particular painting production requirements with greatest economy and maximum efficiency—whether it be for parts, partial assemblies or completely assembled airplanes. Completely assembled four-engined bombers were spray painted in Mahon equipped enclosures during the war. Consultation with Mahon engineers will not place you under obligation.

Address correspondence to INDUSTRIAL EQUIPMENT DIVISION

THE R. C. MAHON COMPANY

Home Office and Plant, Detroit 11, Mich. • Western Sales Division, Chicago 4, Ill.



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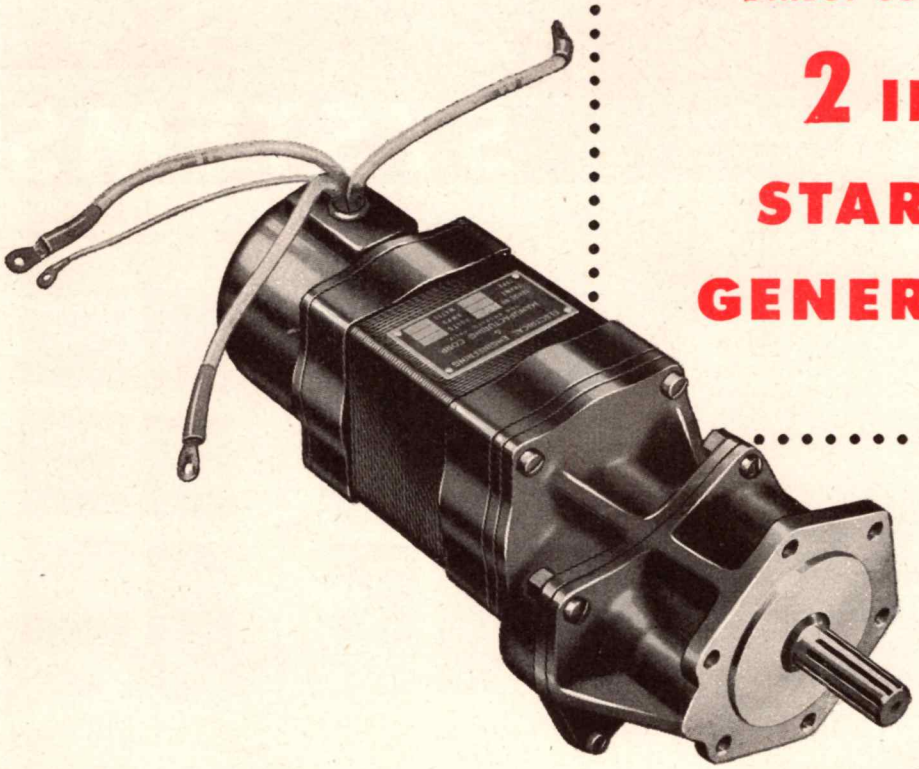

SAVES GEARING

SAVES WEIGHT

...INCREASES AIRCRAFT PAY LOADS

Here's another EEMCO special design. Separate gear-driven generators and starters can now be replaced by one *single-unit, direct-drive* starter-generator that weighs only 19 pounds. An EEMCO starter-generator on an aircraft engine can save up to 20 pounds of weight This means more gasoline (extending cruising range) or more baggage can be carried. In addition, wiring and servicing is simplified and space is conserved through the 2-in-1 design.

These sturdy units are built for long service. They have plenty of torque for starting four-cylinder engines up to 125 hp. This same torque will start even larger six- and eight-cylinder engines. As generators, they deliver 500 watts, continuous duty. A torque-limiting device built into the unit protects against damage from engine backfire. The direct connection to the engine crankshaft eliminates need for gear drives.

TECHNICAL DATA

Rated at 500 watts, for 12-, 24-, or 32-volt systems, at 50° temp. rise Maximum starting torque is 160 foot pounds. Two gear reductions incorporated in unit: 23 1 for cranking; 2½·1 for generating. Torque-limiting clutch built in. Can be fitted to most engines through available adapter mounting brackets.

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BOEING *STRATOCRUISER*

(Continued from page 57)

standards for the industry. These eliminate the need for special handling equipment at the airport. The all-cargo version has aft-end folding ramps on which self-propelled vehicles, such as 1½-ton trucks, may enter or leave the hold under their own power. Other rolling stock may be hauled into the plane or lowered down the ramp by means of a self-contained winch and cable. An overhead rail runs the full length of the upper fuselage, along which operates an electric hoist. There is sufficient clearance under the two aft doors of the cargo version for trucks to back under the opening. The hoist is then used to lift cargo from the bed of the truck into the fuselage.

Hoist Expedites Loading

Pre-loaded pallets, each accommodating 5000 lb, can be picked up by the hoist from trucks and moved into the upper compartment via the ceiling rail. With this system, a load of 20,000 lb can be taken aboard in a matter of minutes. The truck bed-height of the lower cargo doors provide for loading or unloading standard trucks without the necessity of transferring the load with lift trucks or other special handling equipment. Numerous tie-downs are conveniently located in the floors of the cargo compartments.

A large part of air transport time on the ground in the past has been taken up by ground service, maintenance and inspection. *Stratocruiser* designers engineered into the plane hundreds of conveniences to make these operations easier and faster. The two-lobe fuselage construction makes it possible to group plumbing, electrical and control assemblies for greatest convenience.

The *Stratocruiser* is 110 ft 4 in long, 12 ft longer than the B-29. Its dorsal

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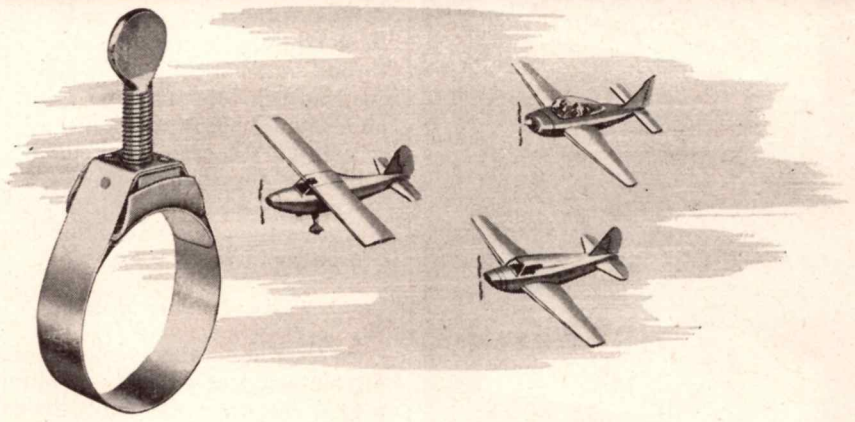
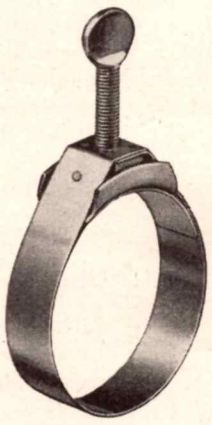


TYPE FBP



TYPE FBSS

TYPE WWD

The great fund of aviation production knowledge developed during the war by aircraft parts manufacturers is now being turned to peacetime planes, commercial and personal. Wittek now offers manufacturers of these planes the FBP Hose Clamp.

The new Wittek FBP Hose Clamp, made from stainless steel and having a band ½″ wide, follows the basic FB design, incorporating lighter construction and economy—yet retaining the high Wittek standards for dependability, high grade materials and good workmanship.

In addition to the FBP, FBSS and WWD, Wittek manufactures a complete line of Hose Clamps of various designs. There is a Wittek Hose Clamp to meet every aircraft application. Write for full particulars.

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fin reaches to a height of 38 ft above the ground. The fin can be folded downward for hangar clearance, similar to folding wings on Naval carrier-based airplanes. Wing span is 141 ft 3 in, fuselage height is 15 ft 9½ in with a maximum width of 11 ft. The main cabin is 74½ ft long.

A feature of the airliner is the unique altitude-conditioning system which starts functioning the minute the plane leaves the ground. The flight engineer, by setting simple controls in anticipation of the duration of flight and the altitude at the next stop, under nearly all conditions can have the cabin "flown" automatically on a flight plan independent of the airplane flight. The cabin atmosphere gradually assumes the altitude of each succeeding stop, cushioning the change, insofar as the passengers are concerned, regardless of whether the plane's ascent or descent is to be rapid or slow.

Varying Pressures in Cabin

Sea level atmospheric conditions can be maintained at all times at altitudes up to 15,000 ft. At 20,000 ft the cabin altitude may be kept down to 3000-ft atmospheric conditions. At 25,000 ft the cabin is at 6000-ft conditions and at the 30,000-ft service ceiling the passengers enjoy an altitude of 8000 ft.

Devices for the maintenance of quality air completely change the air in the cabin every 1 1/3 min. Fresh air, processed for the desired temperature, enters the cabin at the rate of 80 lb a min from compressor elements in the auxiliary powerplants. This fresh air mixes with the spent air in the return system, is heated and then passes through an air processing device.

The processed, fresh and odor-free air enters the distribution duct system and flows up the side walls of the cabin between the lining and soundproofing and between the dual glazed windows to enter the cabin through grille work in the ceiling. This distribution system, providing a combination of radiation and convection air conditioning systems, is an efficient means of supplying passenger comfort. It also spells an end to frosting or steaming of windows, including those of the control cabin.

Spent air leaves through grilles located at the juncture of walls and floor, flowing back through the return duct system to the air recovery mechanism. Eighty lb of air flow overboard through the cabin pressure register per min and are replaced by the same amount of fresh air brought in by the compressors; 3740 cu ft of air per min enter the cabin to provide true air and altitude conditioning.

Cabin heating elements are adequate to maintain a 73°F temperature with outside air as low as —70°F. When outside temperatures are such that cooling is an aid to passenger comfort, inside temperatures 10° below the surrounding air can be maintained.

The *Stratocruiser* is powered by four Pratt & Whitney *Major* engines, rated at 2800 hp normal and 3500 hp for takeoff. Four-bladed Hamilton Standard variable pitch *Superhydromatic* propellers, 16 ft 7 inches in diam, absorb the power. Powerplants are quickly removable, or accessible without removal for inspection, adjustment or minor repair. All four units are interchangeable to simplify overhaul and engine change procedures. Large, easily-reached areas surround most of the equipment. In addition, the designing or selection of superior types of installations has in many cases eliminated or minimized the necessity for ordinary maintenance work.

All d-c electrical accessories and accessory systems on the plane are powered from a 28-v single wire, ground return system from two 30-v auxiliary powerplants. Either or both generators can feed the main electrical power system at the discretion of the flight engineer. Power is distributed from a central station. A 24-v, 34-amp hr battery, "floating" on the main system,

(Continued on following page)

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(*Continued from preceding page*)
completes the d-c power supply.

A-c power at 115 v, 400 cycles is furnished by either of two 2.5 kva alternators in the powerplants for operating a-c instruments and fluorescent lights. Busses have been routed and proportioned to require minimum weight while adequately meeting the regulations concerning limit current loads. Relay conductors are utilized where worthwhile savings of heavy conductors are possible.

Separation of the functions assumed by the auxiliary power system from the propulsive function of the main powerplants permits more power for thrust, considerably simplifies engine changes and permits full nacelle interchangeability.

To complete the *Stratocruiser's* versatility as a short-, medium- or long-range transcontinental or transoceanic airliner, the spacious control cabin provides flexibility for three to five crew members, the number dependent upon the needs and preferences of individual operators.

Recommended for use on the continent is an arrangement by which the co-pilot assumes the normal duties of the flight engineer, the third member of the crew becoming radio and navigational officer. A full crew of five would have distinct duties and locations for pilot, co-pilot, flight engineer, radio operator and navigator, each with modern installations suitable to the wishes of the purchaser.

The pilot and co-pilot are provided with a common (single) set of engine, trim tab and miscellaneous controls. All instruments and controls are located within easy reach of either pilot for normal division of their duties. This type of installation permits generous reductions in weight and contributes to smoother and more accurate control of "in-flight" adjustments, in addition to simplifying maintenance. Instruments frequently referred to are located nearest to the pilots' forward line of sight, reducing fatigue. They are also arranged to permit windshield vision of an unusual degree for commercial aircraft.

Locks for Control Surfaces

Controls operate on extra large pulleys, with minimum changes of direction and a maximum of straight runs. Elevator controls are duplicated in all elements. The main control surfaces are provided with locks actuated by a parallel connected control system, interlocked with the throttles so that takeoff with immovable surfaces is not possible, and so that the surfaces cannot be immobilized in flight. However, this system permits any two engines to be run up to full throttle with the surfaces locked, thus permitting safe taxi ing and engine run-ups in high winds.

Structural efficiency is attained in the Boeing "117" high aspect ratio wing by distributing bending loads between the two spars and the reinforced covering. The spars are of the web type with extruded chords. Interspar ribs of the inboard wing are of built-up construction with web channel stiffeners and chords, while those of the outboard wing are of the hydro-pressed pan type. Nose and tail ribs are also of the hydro-pressed pan type.

To prevent wrinkling under load, heavy gage skin, reinforced by extruded spanwise stringers, is used. Aerodynamic cleanness is maintained by the use of flush rivets and butt joints throughout. The inboard wing-to-stub joint at the body, and the outboard wing to inboard wing connection, just beyond the outboard nacelles, consist of butt joints securing both spars and wing covering.

For maintenance and inspection purposes, controls, plumbing and wiring may be reached by removal of leading edges or by lowering of the flaps. Extra large Fowler-type flaps are used as one of the means of guaranteeing the best performance of the plane compatible with safety. Each flap operates on five tracks and is actuated by electrically-operated screws.

Fixed empennage surfaces consist of hydro-pressed ribs, sheet web spars, formed sheet metal stringers and metal skin. Movable surfaces have hydro-pressed ribs with fabric covering. Fabric fastening is accomplished by flush fasteners designed for the structural security required at high speeds. The *Stratocruiser's* dual wheel tricycle landing gear is augmented by a retractable tail skid, capable of withstanding loads resulting from abnormal landings. The two main gear units retract into the wing and lower inboard nacelle fairing and are covered by doors.

The steerable nose wheel, which can also be swivelled approximately 60° on either side of the forward centerline, reduces taxi time, particularly on busy airports, contributes to pilot ease and greatly reduces brake maintenance. Landing gear units have electric retracting mechanisms with control circuits actuated by a single landing gear switch. A manual retracting system, independent of the electric motors and control circuits, is provided for each main gear and the nose gear. The manual system for each main gear may be actuated by a portable motor in lieu of a handcrank.

Layout of Fuel System

Wing-carried fuel cells in four groups have a total capacity of 5860 gal. The total capacity, when 1195-gal wing center section cells are used, is 7055 gal, and under special loading conditions with 1220-gal external cells, 8225 gal. Each engine may draw fuel from its designated tank group or from a manifold line into which any or all tanks can be discharged as desired. Each tank group is discharged to the fuel distribution system through a booster pump which assures freedom from vapor lock and loss of fuel pressure at altitudes. Booster pumps have selective speed controls to satisfy variable altitudes and starting requirements.

Fuel quantity gages, boost pump

"Downtown" landing strip recently opened at Milwaukee by Lange Aviation, operator of adjacent Milwaukee "Seadrome." Runways, 2500 by 50 ft, and water landing area are close to city center

BOEING *STRATOCRUISER*

(Continued from preceding page)

controls, pressure gages and tank selector valve controls are coordinately arranged on a functional control panel which also serves as a fuel system diagram. No reading of instructions and mental analysis of valve and pump manipulation are required prior to action. Fuel quantity gages are of the electronic type with tank elements located to minimize errors due to roll and pitch. Quantity indicators have large dials with sizeable divisions for accurate reading. The lower wing covering has large removable sections affording access within all fuel cells. In addition, smaller, quickly removable doors provide ready inspection access to individual fuel cells.

Leading edges of the wings from the inboard nacelles to the wing tips, the dorsal and vertical fin and the stabilizer are protected from ice formation by a thermal anti-icing system. The leading edges of these surfaces are so constructed that from 12 to 15% of the chord contains chordwise air passages. These passages are connected by a D-shaped duct in the leading edge.

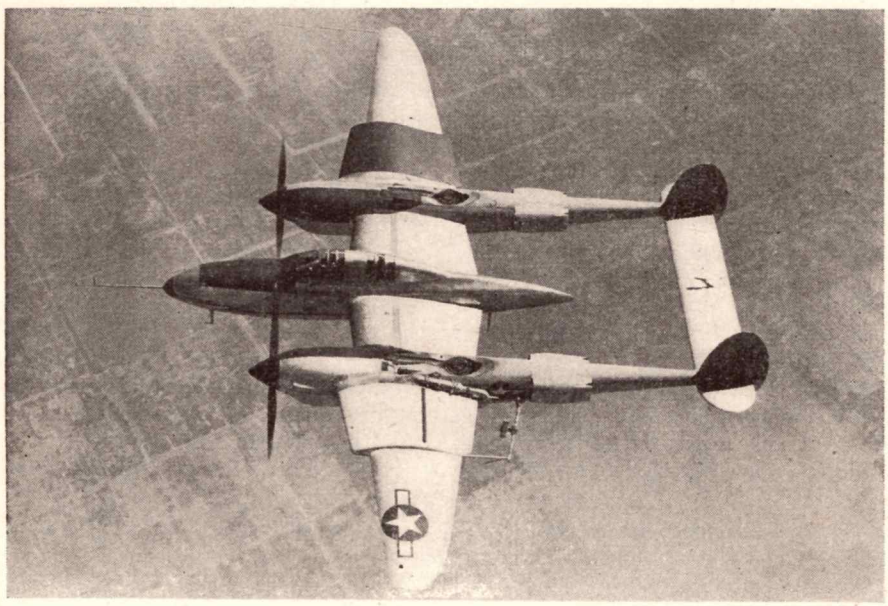
Air heated by the auxiliary power units in the outboard nacelles is introduced into the D-duct This air flows through the chordwise passages, heating the outer skin, and discharges into the rectangular duct formed by the wing skin, baffle and front spar. This duct carries the air spanwise and outboard to be discharged through exhaust louvers in the upper surface skin.

The air temperature is automatically regulated not to exceed 350° F to assure no overheating of structure or fuel supply. A total heat quantity of 1,200,000 Btu's per hr is available. A by-pass duct connecting the entire system to both auxiliary powerplants is provided so that in the event of failure of either unit, ice protection will be available to all surfaces.

The *Stratocruiser* uses hydraulics as the actuating force for service brakes, emergency brakes and nose wheel steering gear. The brake system is served by a service accumulator with a capacity for several full brake applications. This is supplemented by an emergency standby accumulator of equal capacity, connected in such a manner that it may be charged to full pressure and isolated by means of the charging valve.

Pressure in the service accumulator is maintained by a pressure switch-controlled pump drawing on a 3½ gal reservoir. The emergency accumulator also may be charged by a hand pump located in the cockpit. The system is afforded additional protection by an emergency relief valve. A separate emergency brake system operating from the emergency accumulator is controlled by levers accessible to both pilots.

The fire protection system is manifolded so that the entire supply of fire extinguishing agent may be directed to a single nacelle if necessary. Remote electric control facilities have made reductions possible in the weight of the system. The piping assures adequate coverage in both the engine power sections and in the engine accessory zones.



Lockheed P-38, fitted with envelopes, or false wings, special static tubes mounted aft of trailing edges, and yaw meter protruding from nose, used for testing wing designs for fighter and transport planes

Trainer for Fighter Pilots

● A radar trainer, designed and produced during the war by Link Aviation Devices, enabled Army and Navy pilots to practice fighter interceptor procedures under simulated operational conditions.

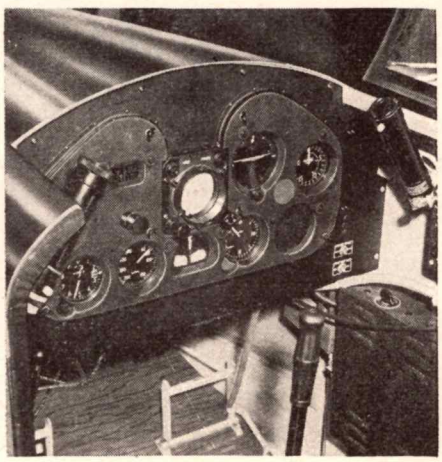
The trainer consists of a unit similar to the standard Link Instrument Trainer in which is installed radar equipment of the same type as is used in combat aircraft, a remote indicating cabinet, and the instructor's table.

Signals appearing on an indicator scope in the cockpit of the trainer guide the "fighter" toward a simulated enemy aircraft many miles away. The course of the enemy "plane" is controlled by the instructor at the table, and its position is represented on the pilot's scope. The airspeed, altitude and heading of the target can be changed at will by the instructor in an effort to elude the pilot. Progress of the problem is shown by "fighter" and "target" recorders which trace on the table the path flown by both the interceptor and the enemy.

Two types of signals are reproduced on the pilot's scope—one used at the start of the problem for scanning a large and distant area, and the other to magnify the image when the "enemy" comes within a range of approximately four miles.

One of the most complex problems encountered in the development of the trainer was the relation of the attitude of the pilot plane to the target. This was a constantly changing relationship caused primarily by the distance, azimuth and attitude of the target. By evolving a system of spherical triangulation, in which mechanical, electrical and electronic factors were coordinated, the problem was solved, and accurate indications on the scope were attained. A light projecting instrument, designed by Link engineers, insures exact positioning of the target.

Instrument panel of Link Trainer, showing location of radar scope



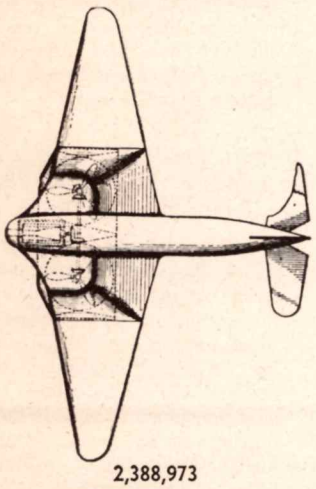
TREND of INVENTION

These patents, of interest to the aeronautical industry, were compiled from recent issues of the *Official Gazette* of the U. S. Patent Office. Copies of the individual patents, in pamphlet form, may be obtained from the Commissioner of Patents, Washington, D. C., at a cost of ten cents each

Shatterproof Plastic. Bjorn Andersen, Maplewood, and Ernest Schweizer, East Orange, N. J., assignors to Celanese Corp. of America. (2,387,227)

Flanged Nut. Otto Haas, Richmond Hill, N. Y., assignor to Aircraft Screw Products Co., Inc., Long Island City, N. Y. (2,387,257)

Regulation of the Combustible Mixture for Internal-Combustion Engines. Prosper L'Orange, Stuttgart-Feuerbach, Germany, vested in the Alien Property Custodian. (2,387,277)



2,388,973

Airplane. Harry A. Hofgren, Chicago, Ill. **(2,388,973)** Illustration

Parachute Pack. John Raymond Cuthbert Quilter, Woking, England. (2,387,350)

Clamp. Frank C. Wallace, North Hollywood, Calif., assignor to Herman H. Helbush, Los Angeles, Calif. (2,387,371)

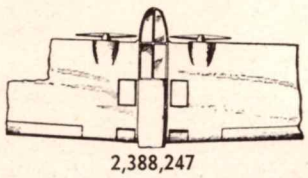
Anti-Icing Device for Aircraft. Lester Almon Bierly, Massillon, Ohio. (2,387,637)

Orienting Instrument. Loring Pickering Crosman, South Orange, N. J., assignor to Monroe Calculating Machine Co., Orange, N. J. (2,387,647)

Radio Direction Finder. David G. C. Luck, Hightstown, N. J., assignor to Radio Corp. of America. (2,387,670)

Fuel Injection. Roderick W. Stelzel, East Orange, N. J., assignor to Bendix Aviation Corp., Bendix, N. J. (2,387,690)

Spill for Aircraft. Albert A. Arnhym, Los Angeles, Calif., assignor to Solar Aircraft Co., San Diego, Calif. (2,387,708)



2,388,247

Airplane. Murray Berkow, New York, N. Y., assignor to Central Aircraft Corp., Keyport, N. J. **(2,388,247)** Illustration

Explosion Rivet. Lawton A. Burrows, Woodbury, N. J., assignor to E. I. duPont de Nemours & Co., Wilmington, Del. (2,387,742)

Director Trainer. Richard C. Darnell, Champaign, Ill. (2,387,749)

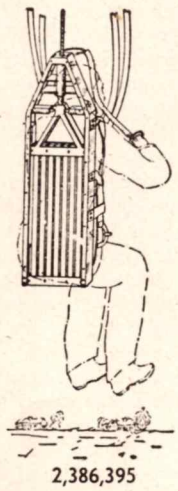
Aircraft Control Apparatus. Siegfried G. Isserstedt, Toronto, Ontario, Canada, assignor to Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. (2,387,795)

Navigation Trainer. Mark Brann, Arcadia, Fla. (2,387,875)

Rate of Turn Meter and Bank Indicator. Paul A. Noxon, Tenafly, N. J., assignor to Bendix Aviation Corp. Bendix, N. J. (2,387,938)

Airplane Towing Mechanism. Orval Rasor, Portland, Ore. (2,388,013)

Altimeter. Otto Weil, New York, N. Y. (2,388,027)



2,386,395

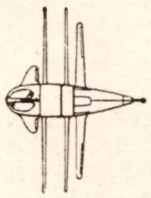
Shock Absorber for Parachutes. Russell Hart, Los Angeles, Calif. **(2,386,395)** Illustration

Air Scoop for Airplane Engines. Theodore C. Barber, Burbank, Calif. (2,388,028)

Control Lever. Murray B. Rhodes, Kew Gardens, N. Y., assignor to The Glenn L. Martin Co., Middle River, Md. (2,388,079)

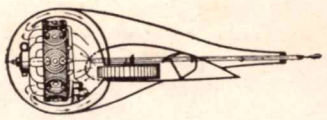
Glider. Charles F. Abel and Albert I. Lodwick, Lakeland, Fla. (2,388,109)

Floating Breakwater for Seaplanes, Flying Boats, and for Other Uses. Edward W. McVitty, New York, N. Y. (2,388,171)



2,387,762

Aircraft. Lloyd H. Leonard, Washington, D. C. **(2,387,762)** Illustration



2,388,806

Aircraft. Edward A. Stalker, Ann Arbor, Mich. **(2,388,806)** Illustration

Range-Finding Apparatus (Aircraft). Barnes Neville Wallis, Weybridge, England, assignor to Vickers-Armstrongs, Limited, Westminster, London, Eng. (2,388,197)

Airscoop for Internal-Combustion Engines. Frank C. Mock, South Bend, Ind., assignor to Bendix Aviation Corp., South Bend, Ind. (2,388,213)

Electromagnetic Wave Direction Indicator. André Ganiayre and René Hardy, Lyon, France; vested in the Alien Property Custodian. (2,388,262)

Radio Direction Finding System. Carl-Erik Granqvist, Stockholm, Sweden, assignor to Aga-Baltic Aktiebolag, Stockholm, Sweden. (2,388,263)

Combustion Heater. George A. Page, Jr., Creve Coeur, Joseph Jerger, and Raymond Rugge, Ferguson, and Philip R. Watson, Webster Groves, Mo., assignors to Curtiss-Wright Corp. (2,388,364)

TREND OF INVENTION

The following group of U. S. patents and patent applications recently vested in the Alien Property Custodian from Askania-Werke, A. G., all of which pertain to aviation, is now available for licensing to American citizens on a royalty-free basis for the remaining life of the patents on the payment of a fee of $15.

Patent or Appln. No.	Class & Sub-Class	Inventor	Title
2,222,458	33-204	G. Wunsch	Gyro Magnetic Compass
2,217,633	33-204	G. Wunsch	Course Indicating Device
2,166,920	33-204	H. Schuchardt	Flight Attitude Indicator
2,175,165	33-204	W. Heinrich	Remote Control Device
2,077,849	33-204	W. Moller, G. Z. Von Manteuffel	Compass Follow Up
2,126,935	33-222	G. Z. Von Manteuffel	Direction Maintaining Means for Use on Dirigible Craft
2,140,191	33-222	W. Schuchardt	Gyromagnetic Compass
2,129,586	33-264	W. Moller	Gyroscopic Instrument
APC 366,364	60	G. Wunsch, E. Weinkauff, W. Badewski, H. Kobischke	Rudder Machines for Automatic Pilots
2,176,807	73-180	G. Wunsch	Attitude Responsive Device for Craft
2,244,603	74-5	K. Bauer	Gyroscopic Apparatus
2,175,143	74-5	E. A. Cornelius	Gyroscopic Apparatus
2,349,287 (S. N. 321,805)	74-5	A. Krussman	Device for Controlling Processional Forces in Gyroscopes
2,272,986	74-5	E. Weinkauff	Gyroscopic Apparatus
2,344,112 (S. N. 328,935)	74-5	B. Rybka	Gyroscopic Device
2,297,274	74-5	G. Wunsch	Gyroscope

NEW Books

In response to the many requests for information as to books on aviation, AERO DIGEST offers on this page a streamlined book service for the convenience of its readers. If you want any of these books, send us title and author's name, *together with check or money order*, and we will send promptly, shipping charges paid.

Big Distance. By Capt. Donald Hough and Capt. Elliott Arnold. 255 pp. $3.00

A gripping tale of the Southwest Pacific that finds mortal man locked in a death struggle with the uncivilized forces lurking in the African jungle. Still smarting from the recent defeat in the Philippines, Bataan and Corregidor, the American soldier returns by parachute to be swallowed up in the swampy, unmarked, unroaded, unbroken land of cannibals, where the long trek back to victory begins.

The comeback starts with clearing Kurai grass for airstrips where strong men are felled like giant oaks by a death-dealing germ called scrub-typhus. Bit by bit, the boys in khaki claw their way through the jungle, fighting malaria, yellow fever, poisonous snakes and deadly crocodiles as they advance on an average of three or four miles a day.

After more than a year of this savage battle with the uncontrollable forces of nature, the miraculous endurance, courage and good old Yankee ingenuity succeed in clearing the forest primeval for the big battle with the Japs.

The names of Bong, McGuire and Johnson, glamour boys of the Fifth Air Force, begin to show up in record-breaking headlines as they vie with one another in the number of enemy planes shot down in the New Guinea campaign.

In breathless succession, *Big Distance* reveals the dramatic, terrific, tragic exploits of men and planes as they fought not only the Japs, whom they anticipated, but the blinding monsoons and the shifting, tricky, unpredictable tropical climate with which civilized man is wholly unfamiliar. On through the battles of the Coral Sea, Guadalcanal, Kokoda Trail and the Bismarck Sea, where the Japs were finally stopped.

Written by two brilliant novelists from actual experiences, it is a stirring account of America's record achievements on land and in the air.

Diesel-Electric Plants. By Edgar J. Kates, A.B., M.E. 272 pp; index; illus. $3.75

Out of the global conflict that pitted our nation's scientific resources against those of another came the resurging cry for efficiency, economy and power.

And answering that emergency to the tune of 52,000,000 horsepower, a staggering figure when compared to production over a like pre-war period, the Diesel engine played a dynamic role in powering the largest and best equipped navy in the world.

With this wartime impetus given to Diesel production have come important developments and improvements in electric equipment used with Diesel engines, as well as in engine governors for electric drive. Hence, the need for an up-to-the-minute revision of the book that treats the subject so comprehensively that it ran through five printings since 1936.

Listen to the author as he reveals the underlying secrets which gave Diesel top priority in the field of prime movers. Since the electric equipment in the Diesel plant is influenced by the Diesel engine characteristics, the author starts off with the coordinated aspects of this specialized field.

The chapters on Voltage Regulation now include the new quick-acting rheostatic-type regulators, the electronic type, and also the simple vibrating types that have become so popular.

Parallel operation of Diesel-driven generators follows with a brief explanation of the fundamental principles and proceeds to automatic synchronizing, checking, phase sequence, adjustment of field current, etc.

Men skilled in electricity frequently have only a hazy understanding of how a Diesel engine governor works, and how the governor performance affects the frequency and the load control. All this is explained in a chapter largely rewritten to cover the many forms of hydraulic governors now in use, as well as improved mechanical governors.

In the chapter on Electric Starting of Diesel Engines will be found considerable practical information derived from recent texts.

The electric transmission systems used on modern Diesel locomotives incorporate many refinements which have been developed during the past few years.

This book, written in direct, easily understood form and with a minimum of mathematics, is a must for the well-informed student of electricity, of powerplant design, and of operation and maintenance; operators and maintenance men of Diesel powerplants and Diesel railway equipment; owners and superintendents of existing and proposed Diesel powerplants; salesmen; and erectors.

Full Production Requires Scientific Distribution. By James Alfred Thorson. 145 pp; illus. $3.50

In this book the author explains in detail his ideas of how distribution can be coordinated and controlled scientifically.

Using figures and data of nationally accepted authorities, he outlines the statistical story of this country at full production capacity to meet the requirements of war, and then proceeds to explain how industry can continue on this scale in the post-war years, showing how the principle can be worked out in any industry or business.

Aircraft Production Design. By James E. Thompson. 238 pp; index; illus. $5.00

A comprehensive reference handbook compiled from material originally prepared by the author for his own personal use on factors governing the "machineability" of mechanical designs, which he later developed to include factors governing the manufacturing practicability of all forms of aircraft parts.

The handbook is divided into nineteen sections, covering designing for production; serviceability of designs; repairs as a factor in design; lubrication as a factor in design; materials for airframe construction; designing for machineability; drilling, reaming, counterboring and threading; turning, boring and grinding; milling and broaching; sand and permanent-mold castings; die, pressure mold and centrifugal castings; forgings; wood airframe parts; fusion welding; resistance welding, brazing and soldering; cutting and bending sheet metal parts; the forming of sheet metal parts; drawing sheet metal parts; standard parts and designs.

The volume is directed specifically to the aeronautical draftsman and designer, who will obtain from it a thorough understanding of the tools and processes used to manufacture his design.

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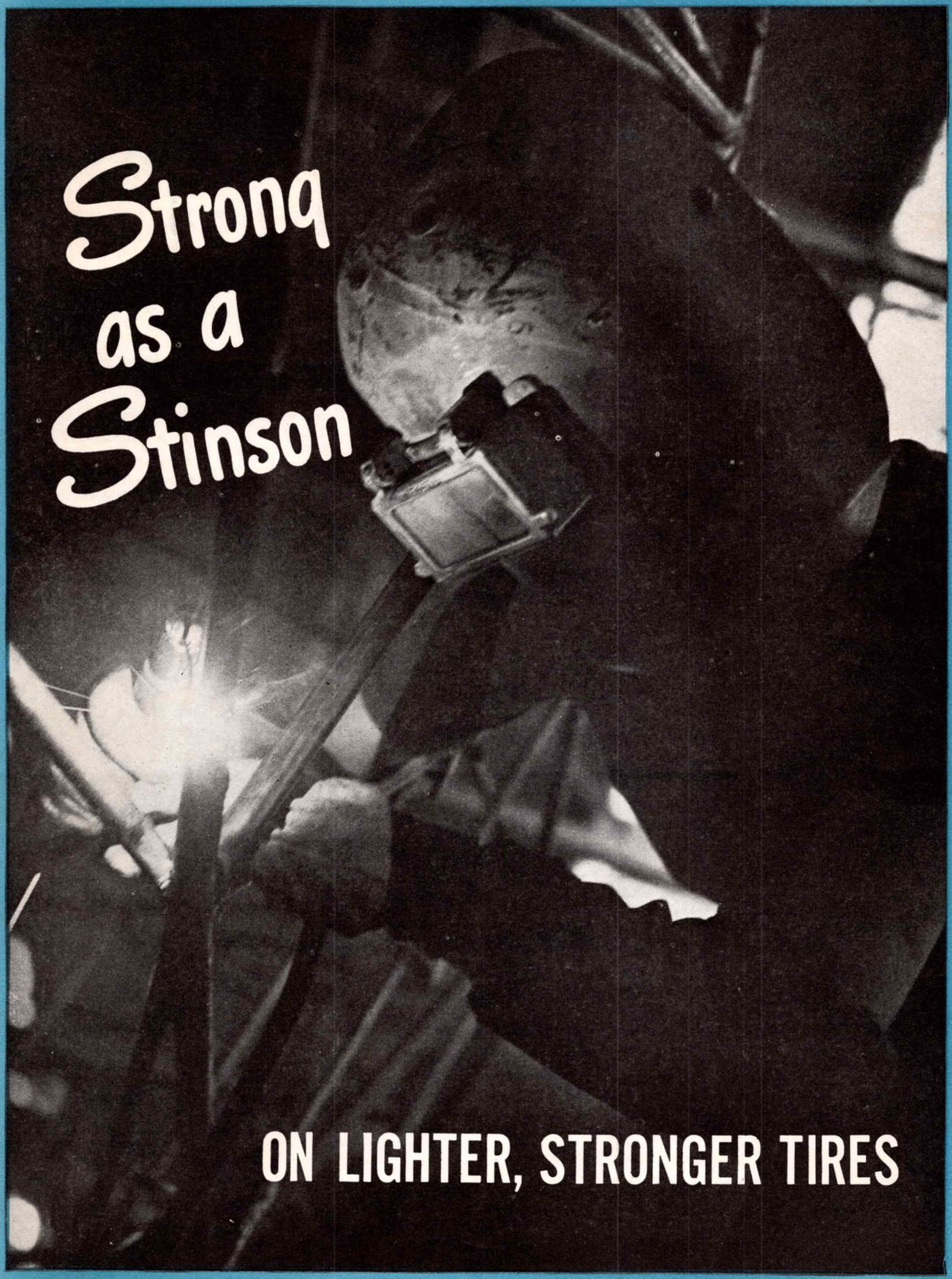

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From "Eddie" Stinson's

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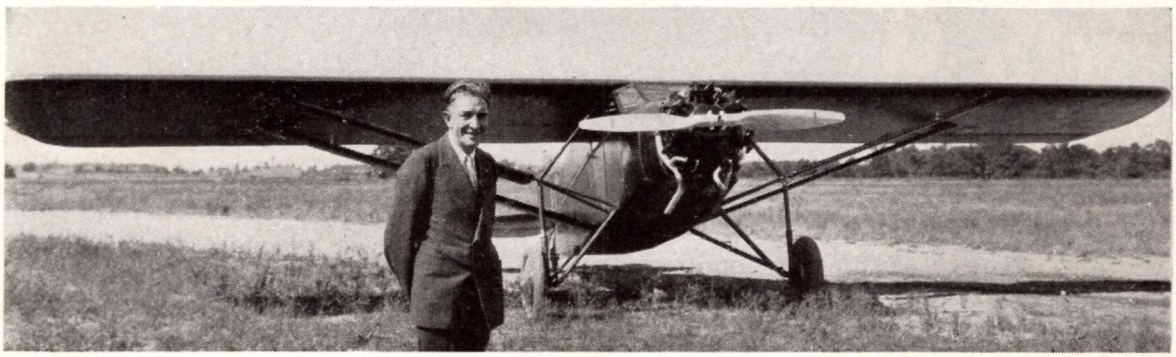

1926 . . . The earliest plane built by "Eddie" Stinson and his pioneering associates gave a new conception of personal aircraft. In this Stinson Junior he flew non-stop from Detroit to Mexico City in 1928.

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WORLD WAR II . . . The strength and stamina of the Stinson "Flying Jeep" along with its extreme maneuverability under battle conditions were dramatically demonstrated in World War II. For observation, liaison, hospital service and even as a super-light bomber, the Flying Jeep earned the honors of war.

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UNITED STATES

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From its stalwart steel framework all the way through to its "mirror finish," the Voyager 150, product of Stinson Division of Consolidated Vultee Aircraft Corporation, is built to bring big airplane performance to the personal plane field. In the tradition of Stinson airplanes since the earliest Stinson plane of nearly twenty years ago, they are built strong and rugged to give luxurious security, ease of handling, and complete dependability. U.S. Royal Airplane tires, battle-tested on the Stinson "Flying Jeep," cushion their landings on every kind of flying field from pasture lot to modern airport.

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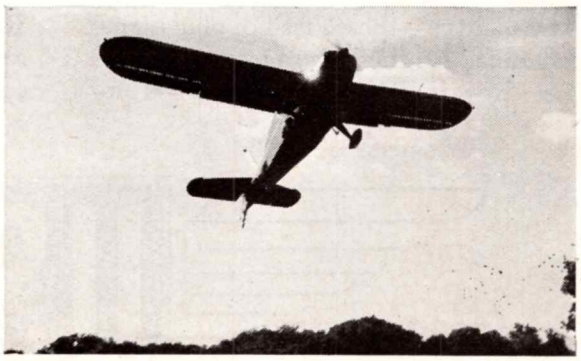

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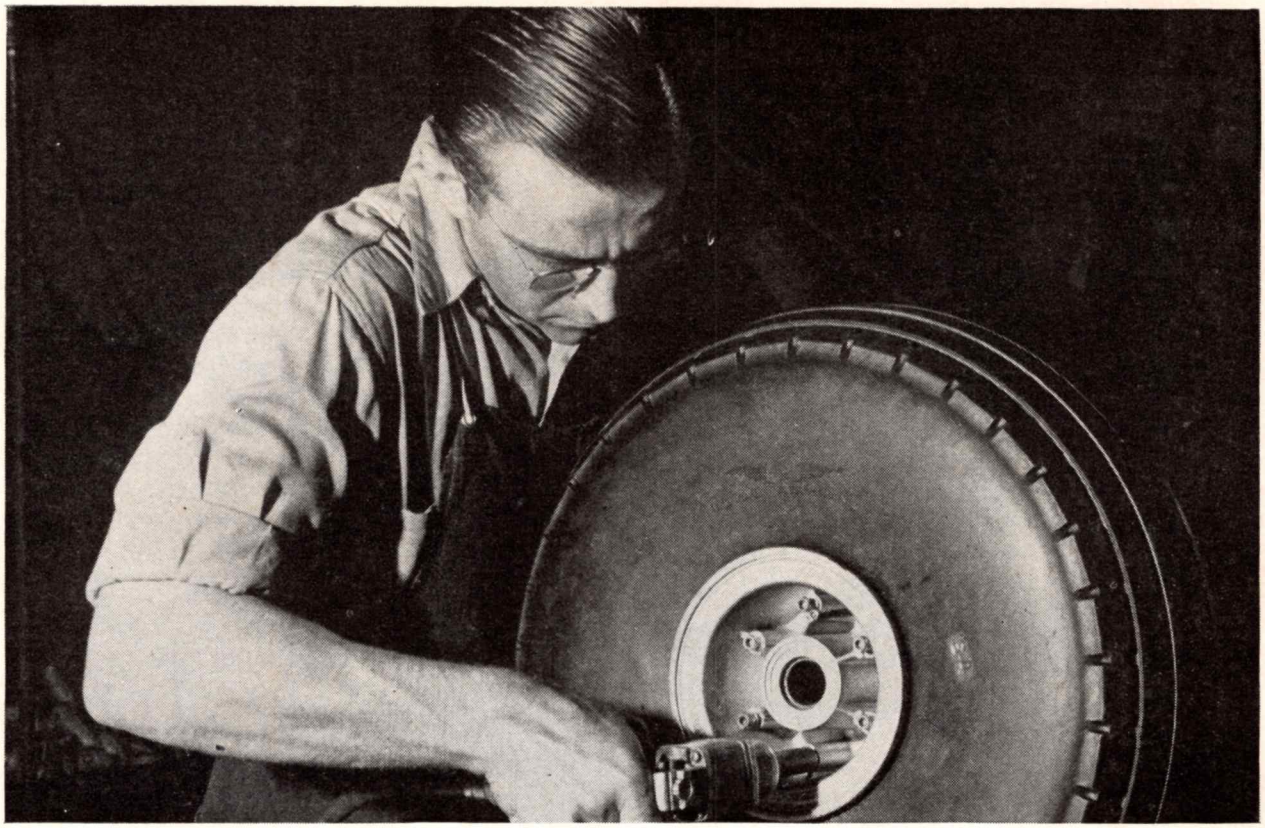

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U.S. Royal Airplane Tires, like Stinson planes, are engineered and built for strength, stability and security. From the first day that "U.S." built tires for the "Flying Jeep," they were made with bodies of rayon for the extra-strength, extra-lightness these fast-hopping planes demanded for their rigorous war service. U.S. Royals, specifically designed for rayon, set the standard for the service . . . led the way to new records of airplane tire performance.

For post-war Stinsons . . . for every type and size of airplane from two-seaters to super-transports . . . U.S. Royal Airplane Tires with bodies of rayon and of nylon are ready now to speed the air cargoes of peace.

U.S. TIRES

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RADAR COUNTERMEASURE

(*Continued from page* 49)

ognize its true nature from the fact that it did not move rapidly, nevertheless, when the air was filled with the foil an electronic "smoke screen" was provided through which large numbers of planes could fly without anti-aircraft gunners being able to get an accurate range on any of them.

The most commonly used electronic jammer was an airborne and ship-borne model called *Carpet*. It consists of a tunable radio transmitter provided with a special type of modulation. It transmits radio waves of the same frequency as used by the radar which is to be jammed. Special modulation is required because when regular rhythmic waves are employed the pip on the radar scope representing the target rides on top of the interference and remains visible.

In October, 1943, the Germans got their first taste of U. S. jamming. During the first raid on Bremen, *Carpet*-equipped planes suffered losses less than one-half those of the groups which were not so equipped.

The jammer developed in the Radio Research Laboratories sends out waves modulated by random "noise," an irregular disturbance which, when picked up on a radio receiver equipped with a loudspeaker, or headphones, sounds like a hiss, or distant surf. As seen on the scope of a radar, the "noise" looks like many fine blades of grass moving about in random fashion. Echoes from airplanes, which are usually displayed as vertical spikes on the scope, disappear and become lost in the "grass."

If radar is used for control of searchlights and anti-aircraft guns, jamming can effectively put them out of action. For defensive purposes, particularly against enemy airborne radars, powerful long-distance, ground-based jammers are used.

The first step in setting up countermeasures is reconnaissance, usually by airplane, with an instrument called a "search receiver." This device, which is an extremely sensitive tunable receiver, picks up the operating enemy radars and makes their signals audible through headphones. The pulse width and repetition rate of the radar signals are made visible on an instrument called a pulse analyzer.

When the receiver is equipped with a directional antenna and additional apparatus it is possible to get two or more bearings on the signal source. These bearings, shown on a radar scope, will indicate the location of the radar signal.

These radar detectors have greater operational range than the radar itself, since a radar's range is limited to the distance from which it can receive a detectable echo—the relatively weak return wave. The airborne search receiver, however, receiving the powerful radar signal directly, can hear and locate a radar long before the radar spots the plane.

When employed against an enemy using radar, a search receiver proves to be a better detector than the radar itself. It is a matter of record that the use of search receivers by the AAF often deprived the Germans and Japs of the use of their radar, because they shut them off to avoid detection.

This was especially true when radar search techniques were used against submarines. Nazi U-boat skippers were reluctant, if not downright terrified, to turn on their equipment when far from their bases—preferring to use it only when near home, and then only for navigation in restricted waters.

In order to meet the expected Allied air attacks, the Germans had developed many types of heavy anti-aircraft guns —88-, 105-, and even 128-mm cannon being used. To direct the fire of these guns they standardized on one principal type of fire control radar.

These fire-control units, to which the Allies gave the code name *Wurzburg*, were used both at night and during daylight hours when visibility was poor. They were capable of tracking aircraft with a precision equal to that obtainable with optical control.

Having standardized on the *Wurzburg* type of radar, which represented an investment which has been estimated at a billion dollars, the Germans naturally tried every expedient to keep their sets in operation. Anti-jamming attachments were hastily devised and put into use in the hope that they would reduce the effect of our jamming. In all, some 13 of these devices saw service, and 19 additional schemes were under development at the end of the war.

Two Fundamental Ideas

There were two basic ideas behind these attachments. To avoid electronic jamming, the Nazis tried to shift the operating frequency of their *Wurzburgs*. To avoid *Window*, they built devices which would enable the radars to distinguish between moving and stationary targets. But it was found that the anti-*Window* devices made their radars vulnerable to *Carpet*, because of difficulties in using both anti-*Window* and anti-*Carpet* devices at the same time. For that reason the AAF employed both methods simultaneously. It was later learned that the constantly growing scale of Allied countermeasures made the German anti-jamming devices more or less obsolete before they could be put into service.

By V-E day, at least two radar jamming transmitters were carried in every heavy bomber of the Strategic Air Forces. In all, some ten million pounds of aluminum foil in the form of *Window* strips were dropped over Europe by our British-based bombers alone.

Evidence gathered since the end of the war shows that the effectiveness of German radar-controlled anti-aircraft fire against blind strategic missions during the latter months of the European campaign was approximately 25% of normal. On the strength of this estimate it can be stated that radar countermeasures saved the U. S. Air Forces based in England alone probably 450 planes and 4500 casualties.

Translated into dollars, these 450 four-engined aircraft can be valued at approximately $150,000,000 — about twice the cost of the entire radar countermeasures program. It should be needless to add that the value of the lives that were saved by radar countermeasures is incalculable.

AVIATION'S FRONTIERSMEN

(*Continued from page* 40)

New York in 1909, served notice on the Wrights that they had competition in the field of aviation. There will be references to Hillery Beachey who, in January, 1910, made his bow at the Los Angeles aviation meet with one of the first home-made or "backyard" airplanes, and to the more formal Lieut. Frank P. Lahm, first Army officer instructed by Wilbur Wright in operation of the first flyer purchased for the U. S. Signal Corps in 1909. Another student of the Wrights to pass through, —the first civilian novice—is Walter Brookins.

Included also will be a group of special performers, like Dr. William Green, E. L. Mathewson and Earle L. Ovington—the first airmail carrier; Robert Fowler, whose struggle to vault the high Sierras in the fall of 1911 with a 30-hp Wright Model B became an epic; Mathilde Moisant, one of the first lady flyers in the exhibition game; and Lieut. Col. Lewis E. Goodier, Jr., who might have become a three- or four-star general had not Glenn Martin spun into the ground with him in 1914. Naturally, Glenn Martin himself is there, too.

I like to think that these narratives may some day be expanded for publication in book form. Should that come about, gladly will I dedicate the volume to all the Early Birds of America—living or gone beyond.

PANAMA AIRPORTS

(*Continued from page* 54)

mental trim work will be of aluminum. It will be necessary to sink four wells to obtain an adequate water supply which will be handled by means of a storage reservoir and pumping system. Reinforced concrete will also be used in building the 160,000-gal reservoir which will be earth covered to keep the water cool.

The communications system within the terminal building will consist of telephone, audiphone, public address, air tube, cable, telegraph and radio. A central switchboard with public phone booths will be provided in the upper passenger lobby and public phone booths in the lower lobby also will be connected to this switchboard. All areas and buildings within the airport will be connected with this switchboard.

Private phone lines will connect all spaces and areas leased or utilized by each airline, such as ticket counters, offices, flight watches, freight warehouses, hangar, shops, loading offices, control tower and outside phone and switchboard.

Private audiphone systems will be provided in the following areas of each airline: ticket counter, airline offices, operations, flight watch, and satellite loading offices.

The upper level cable office and each airline ticket counter will be supplied with microphones to announce plane arrival and departure and to call passengers to the ticket areas. These microphones will be connected to loud speakers located in all public areas in the building and appropriate outside locations where passengers and interested public might congregate.

Two-way air tube communications for the transmittal of written documents between ticket office and flight control and operations will be provided for each airline.

Public telegraph, cable and radio stations will be furnished in both the upper and lower passenger waiting room areas. Radio, cable, and telegraph representatives will have direct wires to their central offices in Panama City and will relay all incoming and outgoing messages.

Pneumatic Control System

A pneumatic control system will be part of the plant equipment. Thermostats in each of the above spaces, or group of spaces, will operate secondary controls to maintain optimum comfort conditions.

Individual drinking water cooling units will be distributed at various locations, and there will be five refrigerated storage rooms.

The total connected load of the air-conditioning, refrigeration and drinking water cooling equipment will amount to approximately 500 hp, necessitating a generating plant of approximately 450 kw.

A central refrigeration plant, located in the powerhouse, will provide chilled water for cooling, to air-conditioning units located at various points in the terminal building. A pump will circulate the chilled water to the air-conditioning units, and another pump will lift the condensory water to a spray pond.

Table 1 indicates the spaces to be air conditioned, together with the air-handling capacities of the various conditioning units. Wherever possible, the units shall be placed above a false ceiling in a service space, such as lavatories, checkrooms, etc., adjacent to the room to be provided with air conditioning.

Studies will be made of the temperature loss through glazed areas to determine the type of glass to be used in windows and doors.

Contracts have been let for the clearing of the land, and it is anticipated that this work will be completed by December, 1945, which is the end of the rainy season.

Contracts for construction will probably be let shortly and actual building is scheduled to begin around January, 1946. This program would mean that the airport will be in operation by the fall of 1946.

"AIRPLANE ROW"

(*Continued from page* 82)

chaser. That condition, however, will not always exist. By the time a little salesmanship becomes necessary, we expect to have "airplane row" functioning with a healthy and friendly competition that is bound to react to the benefit of all.

During the past two decades, businessmen have discovered that the old practice of knifing your competitor and living to yourself was fundamentally wrong. When competitors started to get together in groups to work out their mutual problems and press for the common good, the business of all began to swing upward.

That's the theory behind "airplane row." We are bound to lose an occasional *Ercoupe* customer to the fellow down the row because the purchaser likes some gadget on the other airplane better, but the rule will work both ways.

Meanwhile, by getting together in this way and attracting additional customers, we will all be better off when the books are balanced at the end of the year.

FLEET "CANUCK"

(*Continued from page* 66)

slightly and recovery can be made in power-on stalls with a loss of approximately only 50 ft altitude. There is no tendency to drop a wing. It is difficult to spin the aircraft and control force must be held to maintain the spin. Recovery from the spin is immediate on release of all controls.

The airplane has been designed around all-metal construction. The wing consists of aluminum alloy spars and ribs fabric-covered and the fuselage is welded steel construction fabric-covered. All components have been designed for rugged use and to meet conditions encountered on rough fields. Dual flight controls are provided throughout.

Ailerons and rudder are mass balanced and, in addition, the rudder has an aerodynamic balance for lighter rudder control. An adjustable elevator trim tab and fixed rudder trim tab are likewise provided.

Equipped with Hydraulic Brakes

It is equipped with Goodyear single disk, or interchangeably, Firestone hydraulic brakes are provided and are toe-operated. A Scott steerable and fully swiveling tail wheel is installed. Standard equipment includes airspeed indicator, altimeter, tachometer, oil temperature indicator, oil pressure indicator, as well as cockpit heater and packing brake.

Allowance has been made for the following additional features: radio, sun shades, external starting plug, starter, generator and battery. The prototype is designed with a stick control but allowance has been made for the installation of wheel control.

Every part of this aircraft is built to withstand an acceleration of 7G's and it is stressed to a load factor of 7 which would permit full acrobatics by U. S. factors. The *Canuck* is available with wheels, skis or floats.

The first production aircraft are equipped with a Continental C-75 Series 1275 horsepower fuel injection engine driving a Sensenich propeller. The fuel injection engine was chosen as the standard engine to eliminate an ever present source of danger in carburetor engines that has caused many engines to cut when throttled back due to the pilot's unawareness of the danger—carburetor ice.

Overall Dimensions

Span	34 ft.
Length	22 ft. 4 in.
Height	6 ft. 6 in.
Wing area	173½ sq. ft.

Luxurious lower-deck lounge of the Stratocruiser

BUY VICTORY BONDS

London—660 minutes by Stratocruiser

Some millions of Americans have recently made new friends in countries all around the globe. Many of those friendships will continue to flourish. For there are no longer any "far-away places." The Boeing Stratocruiser will measure in hours the distance to any spot on earth.

You would expect such an airplane from Boeing—world's leading builder of four-engine aircraft, pioneer in supercharged planes for over-weather stratosphere flight, and creator of the mighty B-29. And the Boeing Stratocruiser will not disappoint you. It is what you want and the airlines need.

The Stratocruiser brings a new, unprecedented standard of performance, operating efficiency and reliability. For it makes full use of the aerodynamic, structural and mechanical advancements developed by Boeing for big bombers and transports during the war. It has a maximum cruising speed of 340 miles per hour and provides exceptionally low operating costs over a wide range of flying distances —from 300 to more than 3000 miles.

Most versatile of all large aircraft, its spacious double-deck design and big payload capacity fit the Stratocruiser for almost every type of medium or long range operation. In the standard, domestic version, 81 passengers may be carried—67 on the upper deck in large, comfortable reclining chairs and 14 in luxurious seats in the lounge—with ample luggage and cargo capacity. As a de luxe transocean plane, the Stratocruiser will accommodate 75 passengers on daylight trips or at night —provide 30 unusually spacious berths plus 15 additional seats—together with baggage and cargo. As a "commuter" transport, it can seat 114 passengers, and in all-cargo operation its 19½-ton capacity and easy-loading provisions make it outstandingly efficient.

For any of these kinds of service, the Boeing Stratocruiser offers the lowest direct operating cost per ton mile achieved by any existing aircraft. To meet the need for all types of feeder and main line operation, other Boeing transports are also on the way.

• • •

The extraordinary performance of the Stratocruiser stems directly from Boeing principles of research, design, engineering and manufacture. You can be sure that any airplane "Built by Boeing" is built to lead.

DESIGNERS OF THE B-29 SUPERFORTRESS • THE FLYING FORTRESS • THE NEW STRATOCRUISER
THE KAYDET TRAINER • THE STRATOLINER • PAN AMERICAN CLIPPERS

BOEING

WASHINGTON

(*Continued from page* 42)

mark was made in the Senate to the effect that unless some fairly immediate steps are taken to provide more and better landing facilities, we may soon have more planes in the air than there is room for on the ground.

Congress has, in fact, received the prediction of qualified officials that within a year or so there will be three times as many licensed commercial planes as there were the pre-war year of 1941, and that the total seating capacity of these planes will be five times as great as in that year. These same experts have made the safe forecast that service will be faster and fares lower.

One other forecast that seems a dead cinch is that even after the airport bill is passed and the money provided, CAA can be expected to move at a snail's pace in carrying out the program. It will have to make new surveys, build up and train an additional staff, draft endless rules and regulations, and attend to all kinds of details before dirt begins to fly on new airports.

Under the Senate version of the airport bill a $375,000,000 program is authorized, while the House increased the volume of Federal assistance to a total of $700,000,000. The Senate bill permits matching Federal funds to be used in paying for land costs. The House bill, on the other hand, limits Federal assistance to the cost of providing the actual landing facilities—that is, grading and construction costs.

The principal bone of contention regarding the bill was tossed in by rival spokesmen for states and municipalities in the form of conflicting provisions concerning the channeling of Federal funds. The aviation industry had no part in starting the fight which ensued. It was only the innocent victim.

The Senate bill seeks to allocate the funds through state aviation agencies, while the House measure permits direct Federal dealing with the cities. It seems a good bet that the conference committee which has just started its task of patching together a compromise bill will come out with something like a $500,000,000 program, with a provision for both state and municipal allocations direct from the Federal administrative agency.

One way of providing additional landing facilities in a hurry for civil aviation would be for the Surplus Property Administration to make military airports that are no longer needed available to municipalities on advantageous terms. It should be good news to aviation that steps are now being taken to do just this. A preliminary list involving some 70 surplus military airports has been sent to the CAA.

Role of CAA in Transfers

The CAA will act in an advisory capacity to the RFC, which has charge of the actual disposition. It will report on such things as the importance of particular military landing areas to the national airport pattern and whether or not the contemplated volume of traffic will be sufficient to justify municipal operation of the facilities.

When one of the surplus military airports is turned over to a state or local government, it is probable that no cash payment will be involved. This is because, as a condition to the deal, the state or local agency will be required to agree that the facilities must be used for public airport purposes on reasonable terms; that approaches to the field will be protected from construction that would prove dangerous; and that proper maintenance standards will be observed. Moreover, the Federal Government, during peacetime, would reserve the right to use the field along with other users up to 25% of its capacity.

In general, the surplus property disposal program is still in a rather bad way. It is like a big bomber that can't quite seem to get all its engines going at the same time. Administrator Symington is doing his level best to improve things, but he is handicapped by the imperfections of the law, and the difficulty that many officials have experienced before him, of trying to make a group of Government agencies pull together.

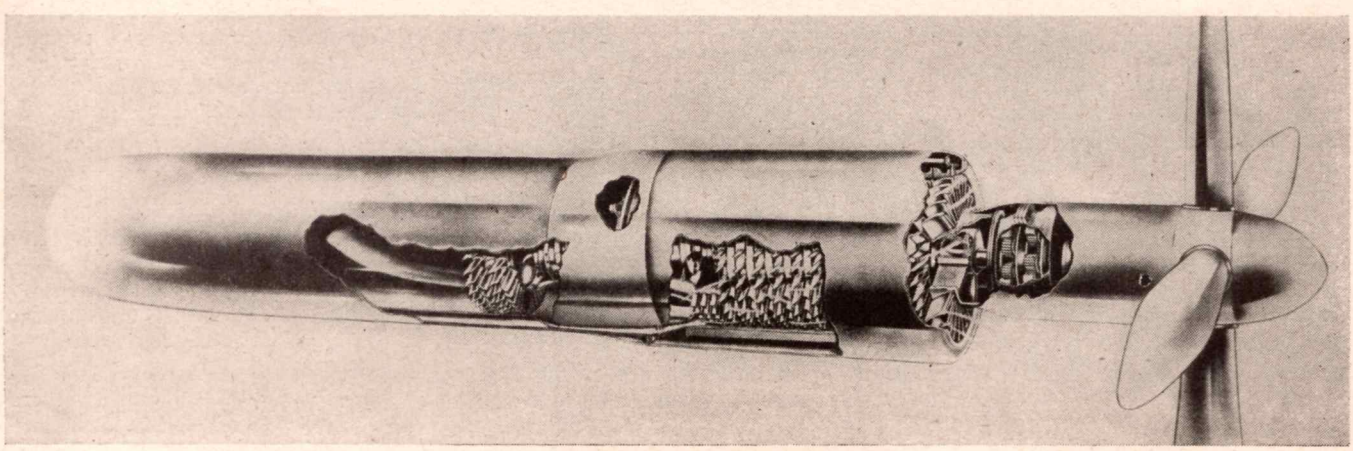
It is not that anybody is consciously trying to mess up the program, but simply that the different agencies have different points of view. In one instance relating to aviation, the procedure has been simplified a little. Closer teamwork between the RFC, which disposes of surplus aircraft, and the Army and Navy has now made it possible in many instances for planes being acquired by state and local governments for memorial purposes to be flown to their destinations.

Under amendment number four, issued by the SPD, these governmental agencies are permitted to purchase surplus aircraft as well as other aeronautical equipment at a nominal cost, for memorial purposes. The same liberalized disposal procedure is applied in the case of acquisition for educational purposes. The charge for a B-17 is something around $350—just enough to cover disposal costs.

What precipitated the ODT order requiring airlines operating from the West Coast to allot 70% of their space to Army and Navy personnel returning from the Pacific was labor trouble. This may sound a little involved at first, but it all adds up once the salient facts are known. It seems that the ODT was apprehensive enough about being able to meet the peak load from the Pacific, which is now running at about 1,000,000 men a month. Of course it won't keep on at this rate for long. Rail facilities linking the Pacific ports with the East have been over-taxed

(*Continued on page* 126)

Jet propulsion unit developed by Westinghouse has diameter of only 19 inches. Using axial-flow compressor, engine produces 1400 lb of thrust. Model below is shown geared to a conventional propeller



Home of the Rockets

- Built for assembly line mass production of the ROCKET—JOHNSON AIRCRAFT recently completed a 41,600 square foot modern factory, where the "World's Fastest Light Plane" is *now* in quantity production.
- A concrete taxi strip, 1400 feet long, joins Johnson Aircraft's newly designed factory to Meacham Field–Fort Worth's multi-million dollar air terminal.
- In this new ROCKET factory the genius of 27 years of aircraft designing experience, together with modern assembly line methods, is dedicated to the mass production of ROCKETS, at low cost to you.

ROCKETS will *soon* be delivering their proud owners the THRILL of a 185 M.P.H. cruising speed–the CONVENIENCE of a 1000-mile range–the SAFETY of 50 M.P.H. landings–and the LUXURIOUS COMFORT of an airliner. The ROCKET, fully equipped, delivers for only $5000 F.A.F., Fort Worth, Texas.

There is *now* AUTHORIZED ROCKET Sales and Service near you–and soon ROCKET Demonstrators will be available for you to see and fly. Write now for full information and name of your nearest authorized ROCKET Dealer.

The ROCKET AIRCRAFT SALES Corp.

FORT WORTH 6, TEXAS, U.S.A.

WASHINGTON

(*Continued from page* 124)

ever since the war started. However, 1200 troop sleepers had been ordered some time ago in anticipation of just such an emergency.

The ODT had been counting heavily on the use of these cars late this year, only to have its hopes dashed by labor trouble which slowed up the production of some of the essential equipment. It now appears that only a few hundred of them will be available before January.

The long and short of it is that for the first time since it has been operating, the ODT has officially asked the airlines to come to the rescue. The companies involved have complied willingly enough, because they are sympathetic with War and Navy Department plans to bring as many of the Pacific veterans to their Eastern homes as possible by Christmas.

The ODT order only reserves airline space for troops making the maximum trip from the West Coast to Eastern destinations. In other words, the only ones to be moved by air will be those making a real transcontinental hop. The question might well be asked: Why doesn't the Army step into the breach with some of its thousands of surplus transports and bombers? Several determined Congressmen have tried to get the Army to do something about this but so far have not had much success.

Incidentally, Congress is beginning to get hot under the collar about the strike situation. A ground swell in the House Rules Committee has already swept two remedial measures toward a House vote that Administration forces had tried to anchor down. These are the Smith-Connally Act repealer, penalizing labor unions violating "no strike" clauses in their contracts, and the Hobbs so-called "anti-racketeering" bill.

This last measure makes it a penal offense for a union to interfere with drivers of trucks engaged in interstate commerce. While these measures admittedly face tough opposition in the Senate, they or similar proposals can be expected to win their way through both Houses if labor disorders continue to increase.

According to AAF spokesmen, the new B-36 bomber, described as "bigger and better than the B-29," is capable of dropping the atomic bomb anywhere in the world. It has been further stated that the B-36 is "far bigger than anything known today and dwarfs the B-29 both in range and carrying capacity." Determination has been expressed by the AAF to participate in the Navy's atomic bomb tests on surface vessels.

Auxiliary Engine Enables Glider to Take Off Without Tow

● Six thousand feet of rope and a tow car or plane are no longer needed to lift the soaring pilot into a thermal, according to Wm. H. Bowlus, pioneer glider pilot and designer of the *Bumblebee*. This new two-passenger glider, equipped with a 4-cylinder opposed, two-cycle engine developing 16 hp at 3500 rpm, is being built by the Nelson Aircraft Corp. of San Fernando, Calif.

The auxiliary engine provides a safety factor in that it can be started at will when thermal activity is at a minimum, when the pilot has soared too far from home base, or when he comes in for a landing.

Fed by a three-gal gas tank, the pusher-type engine-powered glider has an hour and a half fuel capacity at full throttle, and will cruise at 75 mph. On takeoff it will climb with ease at about 38 mph, or 300 fpm, to an altitude suitable for soaring.

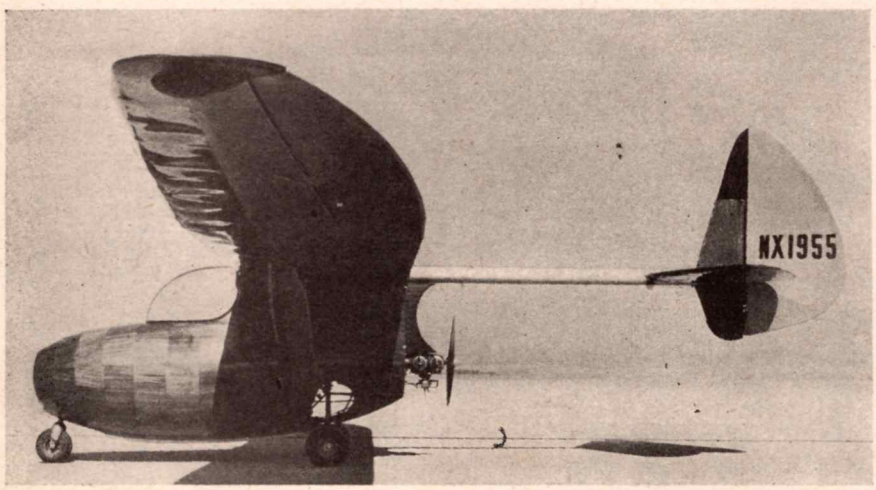
Another unusual feature of the glider is its fully-retractable tricycle landing gear, operated manually by the pilot. The nose wheel is steerable with unique miniature shimmy dampers. The two main wheels have special cam action for retraction into the fuselage, and independent, internally expanding brakes to facilitate taxiing.

The glider is a strut-braced, high-wing monoplane, with dual controls. Wing span is 47 ft and the wing area is 168 sq ft. Its weight empty is 465 lb, and it will carry passengers and baggage totaling 350 lb.

A noticeable characteristic of the *Bumblebee* is the monocoque, dural tail boom which supports the empennage. The remainder of the glider is made of plywood, with a molded shell for the pilots' nacelle. This nacelle is enclosed in a *Plexiglas* bubble.

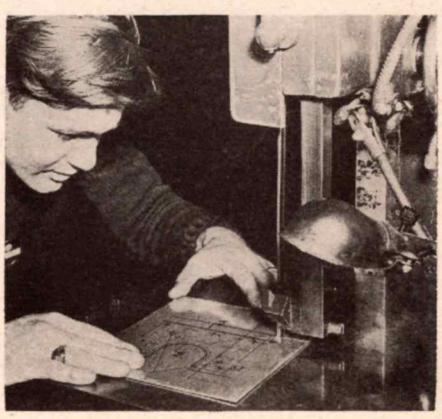
The instrument panel contains a conventional throttle, choke, mixture controls, altimeter, airspeed and sensitive rate of climb indicators. There is also a magneto ignition with impulse starter so the engine will not kick back at any time, and a ratchet wire starter mounted on the crank shaft which enables either pilot to start and stop the engine from the cockpit.

The prototype was flown with a conventional fixed wood propeller, but it is planned to install adjustable pitch propellers on future models.



With aid of a 16-hp engine this new two-passenger glider, the "Bumblebee," can reach soaring altitudes without the assistance of a tow plane

Sawing to outlines photographed directly onto metal templates by "photo-lofting" process developed by Glenn L. Martin plant



QUESTION:

Just how effectively can used oil be restored?

ANSWER: SO EFFECTIVELY THAT OIL NEED NEVER BE DISCARDED!

QUESTION: ***What Steps Are Necessary to Restore Oil for Re-Use?***

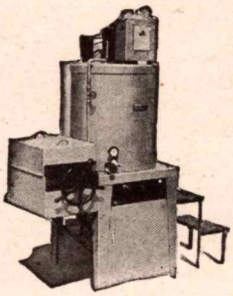
ANSWER: *For best results, the oil should be* heated, *to remove moisture and fuel dilution (if present). Then, solids, asphaltic materials and acids should be removed by contact with earth and filtration. Acidity should be reduced to new oil values.*

QUESTION: ***Can All These Steps Be Carried Out in a Single Piece of Equipment?***

ANSWER: *Yes, the YM Oil Refiner, a single self-contained unit, provides for* both *heating of the used oil, and for* two-stage *filtration.*

QUESTION: ***Is the YM Process Economical and Simple to Operate?***

ANSWER: *For every dollar spent for filtering materials, the YM method removes more pounds of contaminants than any other method known. Automatically controlled, the Oil Refiner needs little attention from the operator—no special skill is required.*



QUESTION: ***Is the Restored Oil Equal to New Oil?***

ANSWER: *Oil restored in the YM Oil Refiner can be used in the same manner and place as new parent oil. In fact, the restored oil, having been tempered, is frequently* more stable *than new oil.*

QUESTION: ***What Kinds of Oils Can Be Restored in a YM Unit?***

ANSWER: *Practically any kind used by industry. You'll find a helpful list in our YM bulletin—just mail the coupon for a copy. Or write us about your specific problem.*

THE YOUNGSTOWN MILLER COMPANY
A Subsidiary of Walter Kidde & Company, Inc.
1210 Kidde Avenue, Belleville 9, New Jersey

The Youngstown Miller Company
1210 Kidde Avenue
Belleville 9, New Jersey

Gentlemen:
Please send me further information about the YM Oil Refiner—and names of users in this locality.

Name_____

Position_____

Company_____

Street Address_____

City and State_____

PERSONAL PLANE BUYER

(*Continued from page* 51)

compass and a reasonably sensitive and accurate altimeter. These two instruments are indispensable to flight operations even of limited cross-country duration. Examine the aft side of the instrument panel and see if the whole assembly may be removed as a unit or if each instrument must be removed singly. Check the general overall placement of instruments. If no radio transmitting or receiving equipment is included in the initial purchase price, ascertain if room is available for placement of this equipment adjacent to or on the instrument panel.

Rubber shock-absorbing mounts tend to increase the service life of instruments. The construction of the instrument panel should be such as to allow ample clearance for movement within the limitations of the shock mounts. The method of mounting the instrument panel should be such as to allow the renewal of these mounts when they are worn or need to be replaced.

If night flying is contemplated, be certain that at least 12-v electrical potential is available. This will provide plenty of illumination for lighting of the cockpit and the instrument panels. In this respect, check the location of the electrical fuse box, and make certain that the fuses can be replaced in flight.

High-winged monoplanes are usually deficient in vision to the rear, and also to the side during certain flight maneuvers. It is to the prospect's interest to make a check of the degree of visibility during various flight maneuvers. This check should be made during a demonstration flight in the lateral and the vertical planes of vision. In the forward vertical plane of vision, make note of how much vision is blanketed by the engine cowling. Test the vision forward and in the lateral plane during climbing or diving maneuvers, and also during steep banking turns. If transparent panels are placed in the wing over the seats to assist in obtaining overhead vision, inquire of what plastic material the panel is made. It is recommended that clear, slightly tinted *Lucite* be used or desired. This material will not discolor, craze, or become opaque with use as a result of exposure to sunlight. This panel should be installed in a manner to permit quick replacement.

Checking Windshield

One-piece windshields offer certain well-merited advantages to the lightplane pilot. Replacement is usually simplified and the vision in the lateral and vertical planes of vision is at a maximum. However, check the method of attachment of any transparent panel in order to determine if quick removal is possible. Also, carefully note if these panels are leak-proof, and if the ingress of drafts is prevented by means of a suitable sealing material.

Control surfaces should be attached by means of self-aligning sealed type ball-bearing hinges. Inquire if the hinges are grease-packed and are sealed. Inspect the ends of control cables where they are attached to the control fittings and see whether swaged type cable ends are used. In reference to cable pulleys, note if these components are made of *Micarta* and whether they are mounted on ball bearings. Aluminum alloy cable pulleys tend to cause wear of the cables and require frequent replacement of the cable and the cable pulley.

It is advisable to examine the operation of the elevator trim tabs. Trim tabs should be operable from either seat in the cockpit, and an indicating device should be provided to show the relative setting of the trim tab.

If a fixed type rudder trim tab is used, check the method of attachment and also note if it is positive in its displaced position. Inspect the attachment of the elevator trim tabs for the method of replacement. See if it is possible to replace the trim tab without removal of the elevator. Also note whether the tail surfaces are removable as units, or if all of the surfaces must be removed to replace one element.

If strap type hinges are used to attach the elevators to the stabilizer and the rudder to the fin, expect frequent maintenance in normal service. Frequently, piano type hinges are used. These may be repaired when worn by means of insertion but are not entirely satisfactory. Piano hinges should be provided with stainless steel hinge pins. Strap hinges should be equipped with replaceable bronze bushings for proper maintenance in normal flight operations.

The electrical wiring circuits of a lightplane are simple. If landing lights are provided as an added accessory to the standard equipment, check to see if pre-focus type lamps are used. This type of lamp has certain advantages in night landings. The storage battery is the actuating source of all electrical energy and should be located in an acid-proof, ventilated container. Make certain that this container has drainage provision to discharge electrolyte to the exterior of the airplane if the storage battery becomes overcharged and the electrolyte tends to boil away.

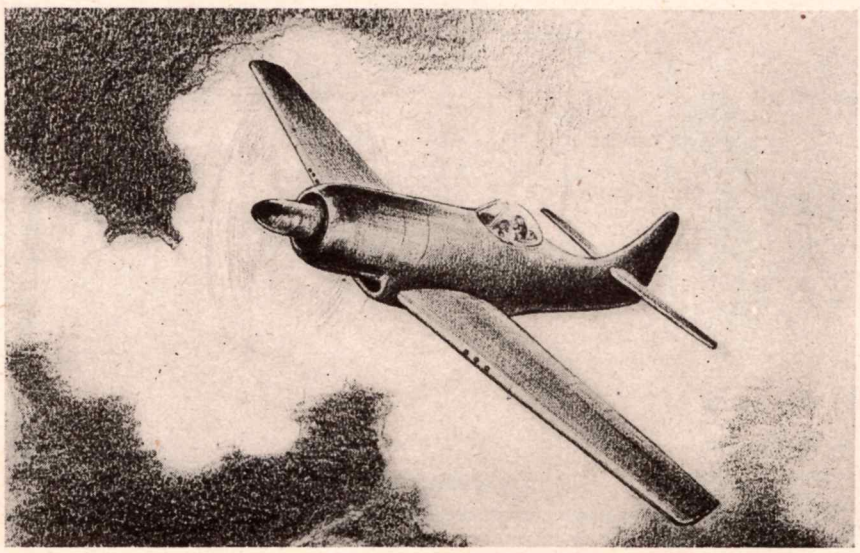
Battery and Generator Check

Check the amp-hr capacity of the storage battery and it is recommended that the engine be started and an inspection of the operation of the ammeter be made. Examine the method of attachment and the driving mechanism of the engine-driven generator. Note if the brushes are accessible for cleaning and replacement. Inspect the accessibility of the generator cut-out relay, voltage regulator, and the control box. Make certain that this electrical box is waterproof.

Test the operation of the landing lights at various settings of the engine throttle and the dispersion of the light pattern. It is also recommended to

(*Continued on page* 131)

Described as world's most versatile fighter, new Boeing XF8B-1 can serve as bomber, torpedo, attack and interceptor plane. Armed with six 20-mm cannon, and powered by a P & W 3600 hp "Major" engine, turning two "Aeroprop" contra-rotating propellers, the plane has service ceiling comparable to that of heavy bomber



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the valuable VALSPAR VAL-AERO FRANCHISE

The air age is not coming... it's here! Airports are converting to peacetime traffic—small planes are already offered for sale by some leading department stores.

The boys are home again... thousands of our young fliers have already returned. More are arriving every day. They are the highly trained, air-minded "younger generation" which thinks in terms of planes.

The demand for plane finishes is no future prospect. It is today's demand. And it means that the distributor with the best line of airplane dope, lacquer and finishes is in on the ground floor—and the sky's the limit to this business!

That's your cue! A full line—a line worthy of the name Valspar—is yours to carry if you hold the Valspar Val-Aero Franchise. This Franchise, which we did not release during the war, is once again available to those few energetic distributors with a weather eye out for real profit and expanding business. Write for details today.

VALENTINE & COMPANY, INC.

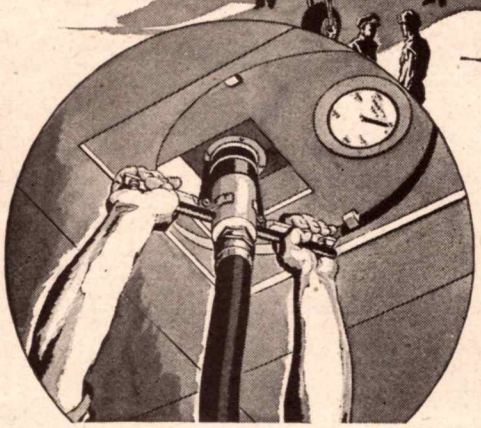
11 EAST 36TH STREET, NEW YORK, N.Y.

WHAT THE NEW

Martin 2-0-2

MEANS TO AIRLINE MAINTENANCE MEN

Mareng Fuel Cells: Featured in the new Martin 202 are elastic fuel cells. These Mareng cells, like the bladder of a football, are easily installed or removed . . . may be quickly repaired.



Quick Refueling: To reduce waiting time at airports, the new Martin 202 is designed for under-wing pressure fueling . . . for oil tank servicing from the ground. No climbing on slippery wings in rain or snow.

THE ease with which the new Martin model 202 transport can be refueled and serviced means more than shorter stops and faster passenger schedules. It also means a lot of time and trouble saved by those unsung heroes of the air lines, the hard-working maintenance men. Unusual accessibility, rugged long-lasting construction, and emphasis on interchangeability of parts—these features make the Martin 202 the easiest plane of its type to service and maintain. Look at the facts listed below and you'll see why the 202 is the answer to a maintenance man's prayer!

THE GLENN L. MARTIN COMPANY, BALTIMORE 3, MARYLAND

Martin AIRCRAFT

Builders of Dependable Aircraft Since 1909

FACTS FOR MAINTENANCE MEN ABOUT THE NEW MARTIN 202!

- Radio, heating and electrical equipment, as well as control cables and hydraulic lines, all are located in the belly of the fuselage—are accessible through large "bomb-bay" type doors. Equipment is grouped to permit work on separate types with minimum of interference.
- Accessories at rear of engines are accessible from wheel-well through removable panel on fire wall. The 202 also permits under wing pressure fueling—oil tank servicing from ground. Adequate, quick-opening panels permit inspection of vital controls.
- Pilot's and co-pilot's flight group instruments removable as unit through nose wheel-well from back of instrument panel. Three-point suspension tubular engine mount is designed for maximum accessibility to engine.
- Flexible Mareng fuel cells, easily removed, installed or repaired. Cabin furnishings easily removable without tools.
- Special attention given to making all parts interchangeable. Wherever possible right and left hand parts are identical. Thus, for example, soundproofing consists of identical interchangeable panels, easily removed or installed without tools.
- Power plant mountings are designed for rapid replacement, right and left engines are interchangeable, cowlings are easily removed. Flexible, long-lasting, fireproof tubing for all fuel lines forward of firewall are specified.
- Landing gear consists of dual main wheels which are safer, lighter to handle, easily replaced—and a new style nose wheel which eliminates the complexity of the dual-sealed-tube type. Convenient jack pads permit easy replacement of wheels and brakes—down-and-up lock arrangement is simplified, reliable.
- These are only a few of the outstanding features of the Martin 202. From stem to stern this plane was designed to meet airline maintenance requirements as determined by long study of airline custom and procedure.

- The Martin 202 is engineered specifically to meet Air Transport Association specifications. Not just designed for the airline but by the airline—custom-built by Martin—to the most exacting standards of the air traveler.

(*Continued from page* 128)

inquire if standard type electrical connections are used throughout the electrical circuits, in reference to disconnect plugs or other electrical connectors. Make certain that all electrical connections are properly insulated. Where wires cross the structural members, they should be provided with tape insulation, and connections should be covered with transparent plastic tubing.

If radio equipment is to be used, the plane must be bonded in a satisfactory manner or poor reception will result. Electrical bonding also eliminates fire hazards which may be caused by the generation of static electricity.

Examine the lift struts of the wing and note if any provision is made for adjustment for rigging purposes. If the wing is internally braced, check the method of attachment to the fuselage structure and its accessibility. For maintenance purposes, a cantilever wing built in two panels and bolted together at the centerline is convenient for replacement. Note whether the fairings around the lift struts may be easily removed and if they have standard screws for attachment.

On a demonstration flight, note the vibration characteristics of the wing panels when the engine is operated at various settings of the engine throttle, including that of taxiing. Ask the salesman to present a typical wing rib and inspect the method of attaching the fabric.

For maintenance purposes, find out where the access panels are located and the method of routing the control elements of the ailerons. Also remove an access panel and see if sufficient hand room is provided. On those airplanes which have bolts piercing the web of the wing spar, look for plastic sleeves in the bolt holes. These will prevent elongation of the bolt holes and maintain a rigid structure. Ask the seller to submit the costs of fabric envelopes available for re-covering the wing structure. On certain types of lightplanes, these fabric envelopes are not always available.

Landing Gear Performance

In order to determine the performance characteristics of the landing gear, taxi the airplane at a moderate speed in a slight cross wind, testing the action of the mechanism by various settings of the engine throttle and noting tail wheel shimmy, if any. Examine the covering on the shock-absorbing mechanism. Determine the location of the various lubrication fittings and see if they are accessible and also what method of lubrication must be used. Lubrication for lightplanes may be accomplished by means of pressure lubricating tools, by manual application, by an oil can, or by means of a brush.

If the shock-absorbing mechanism uses rubber discs, smooth shock-absorbing action will not usually be possible. Frequent replacement may also be anticipated if rubber shock chord is used. Oleo type shock absorbers are superior in performance, using compressed air and hydraulic action to prevent rebound during landing operations. Be certain that provisions for filling this type of shock absorber with air or hydraulic fluid are accessible without recourse to removing a fairing.

The landing gear should be attached to the structure by means of forged steel fittings, designed so that they may be renewed if damaged without the necessity of rebuilding the primary structure. Provision should be made for the renewal of hinge pins. Where streamlined brace wires are part of the landing gear truss arrangement, examine them to make certain they are of the swaged type, have standard fittings, and are made of stainless steel to prevent corrosion or other surface deterioration.

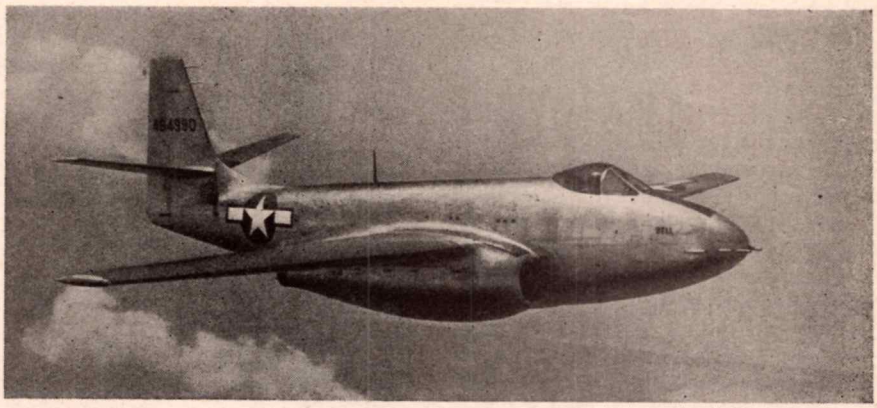
If a hydro-pneumatic type of shock absorber is used, test the operation of the landing gear during snubbing action to observe the presence of air or hydraulic fluid leaks. High-quality hydraulic shock absorber units usually are provided with chevron packing. *Neoprene* packing is long-lasting in service and is resistant in exposure to petroleum products. See whether it is necessary to use special spanner wrenches to disassemble the shock absorber unit, and make inquiry as to whether these wrenches are included in the purchase price of the plane. Where bushings are used, check the possibility of easy replacement when these parts become worn. If the landing gear wheels are provided with metal fairings, make certain that the clearance between the tire casing and the metal fairing is wide in order to prevent mud from stopping the rotation of the wheels.

Brakes should be of the mechanical type for economy and simple maintenance. However, if hydraulic type brakes are desired, make certain that provision is made to bleed air from the supply lines. Check if the brakes can be easily released, should they bind for some reason. Investigate the method used to accomplish brake adjustment.

Cockpit Lining and Trim

The cockpit is of prime importance to the pilot. High-quality planes have the cockpit lined with *fabrikoid*, or other synthetic material from which stains may be easily removed by means of a cleaning solvent. The interior trim of the cockpit should be treated with a chemical to make it fire-resistant.

With side-by-side seating, check the width of each seat to note if two persons may fly comfortably when parachutes are worn. Where the seats are placed in a tandem arrangement, try each seat for proper leg room. Measure the height of the seat above the floor. If this distance is less than 10 in, an extended flight may become uncomfortable.



Designed for long range, and capable of speeds in excess of 500 mph, Bell Aircraft's newest jet plane, the XP-83, is powered by two GE 1-40 engines

Open the baggage compartment and determine the capacity. Not less than four cu ft should be available. It should be possible to carry 50 lb of baggage without the fore and aft trim of the plane becoming critical. Measure the size of the door openings. Make a note of locks, hinges, provisions for holding the door open or closed, and draft-proofing around the edges. For safety, the door should be of sufficient size to permit the exit of a person wearing a seat pack parachute. For comfort, the cockpit should be insulated against cold and noise.

The use of aluminum alloy for the control mechanism makes frequent

(*Continued on following page*)

PERSONAL PLANE BUYER

(*Continued from preceding page*)

compensation of the compass unnecessary. See if the engine primer is operable from either seat for convenience in starting.

When the examination of the plane has been accomplished, ask to see a copy of the maintenance and flight operations handbook, prepared by the manufacturer. For the customer's protection, a copy of the periodic inspection schedule should also be requested. Check the maintenance handbook for information on repairs to any of the accessories not supplied by the airplane manufacturer. If the instructions are deficient in this information, ask the dealer to outline the various repair and maintenance operations which may be necessary in normal service. Also inquire of the airplane dealer if maintenance parts are carried in stock, and if they are not, how much time will elapse before these parts can be obtained. This will prove to be of value if a major part should require replacement.

Before the final purchase contract is consummated, check the sales policy of the airplane manufacturer. Is the dealer who is making the sale well founded to provide service? Is the factory service-minded? How long has the lightplane of this specific type been offered to the public? Is the plane a product of gradual technical improvement and design? Does the CAA require frequent mandatory changes in the manufacture of newer models? Will the resale value be profitable on a turn-in on a newer airplane? What is the general public reaction to this type of lightplane? These and other questions should be answered to the satisfaction of the first-time lightplane buyer before signing on the dotted line.

New Steel Control Cables

● Abnormal slackness in aircraft controls resulting from unequal expansion and contraction of the cables and the airframe will be largely eliminated by the use of control cables made of high nickel manganese alloy steel. A special drawing process, developed by technicians of American Steel & Wire, and closely-controlled heat treatment, are employed in the production of wire for the new type cables.

Plain carbon steel, ordinarily used, expands and contracts at rates different from those of duralumin, of which military and commercial airframes are chiefly made. Consequently, when an airplane passes from temperatures at ground level to the sub-zero temperatures of high altitudes, the frame contracts to a greater degree than the ordinary control cables, thus creating slackness in the cables and sluggish control of the plane.

In passing from a temperature of 70° F to —70° F, an airframe 70 ft in length will contract approximately ¾ in more than the carbon steel control cables. This discrepancy has been overcome in usual practice by the use of temperature compensating devices in the control system which automatically take up the slack. These devices gave added weight to the plane, and their delicate and complicated construction demanded frequent servicing and attention which were not always available.

Use of the new alloy steel results in both weight saving, by elimination of the compensating equipment, and in more satisfactory and efficient handling of an airplane by the assurance of constant tension. It also removes the necessity for extreme rigging tensions, which in many cases increase friction losses in the system to a point where control of the plane brings about considerable pilot fatigue.

NAVIGATIONAL STARS

(*Continued from page* 62)

indicate a line pointing toward it. Alpha Centauri is known by the name Rigil Kentaurus. All these stars were taken up in Part 5.

East and a little south of Rigil Kentaurus is the constellation Triangulum Australe, shaped like an equilateral triangle. Its brightest star, listed by the *Air Almanac* simply as Alpha Tri. Aust., is another navigating star never seen from the United States.

The one remaining navigating star in the south circumpolar region is Achernar, mentioned last month as the brightest star in the constellation Eridanus. Achernar can be seen as far north as San Diego, California, under ideal weather conditions. From the Southern Hemisphere, it is easy to locate because of its brilliance. Its magnitude is 0.6.

Achernar is the fifty-fifth and last of the navigating stars to be pictured and discussed in these articles. When the student navigator has learned all of these stars, he has acquired an ample selection for the practice of celestial navigation anywhere on earth, during any time of the year. Furthermore, once learned, these fifty-five stars will serve him for as long as he chooses to use them.

As for the possible replacement of celestial navigation by future developments, such progress is to be desired. Celestial is too dependent upon the weather at ordinary altitudes, and a little too clumsy at any altitude to be considered an ideal method.

Wartime developments in radar have already eliminated celestial from some flights where it would formerly have been used. Future inventions in this and other fields are certain to bring navigation eventually to the direct-reading science it should be.

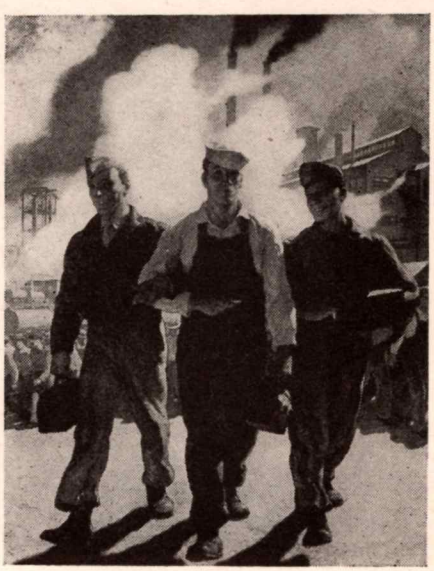
In keeping with this outlook, it might be supposed that celestial will soon be so obsolete as to be worthless. This might be the case, were it not for celestial's one redeeming quality—although a bit awkward in practice, it is the simplest means of position finding in its basic principles.

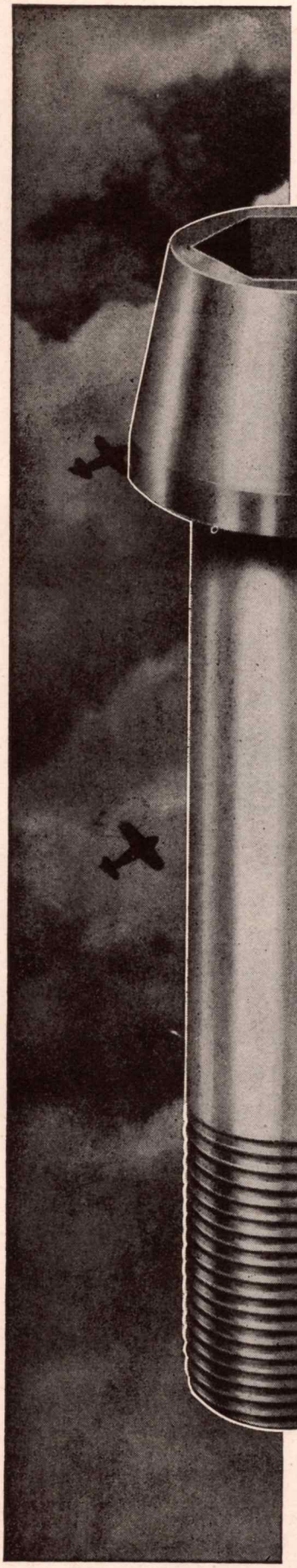
Place of Celestial Navigation

Except for the direct readings taken with an octant or sextant and a chronometer reading, celestial in no way depends upon the proper functioning of instruments in the craft or on the ground. This condition makes celestial navigation a perfect substitute method for use in emergencies. Since it is reliable, economical, and requires little equipment, celestial may be expected to endure in that capacity even after more convenient methods have driven it from the field of everyday use.

Meanwhile, celestial is still with us and still indispensable. It will probably be in common use for some time to come, and so is well worth learning. Because of the likely high cost of new instruments, the private flyer may continue to use celestial after it has been replaced for commercial and military flights. But ultimately navigation by the stars will be ranked in the place where it truly belongs: that of a dependable secondary method.

Poster painted by the late N. C. Wyeth for Hercules Powder Co.—"The Spirit of '46"





AS A *FLYER* WOULD WANT THEM MADE...

With the same high regard for the importance of extreme accuracy . . .

With workmanship, technically skilled . . .

With utmost care to insure finest performance . . .

That is how "Unbrako" Internal Wrenching Bolts, 100° Flush-Head Socket Bolts, and Internal Wrenching Lock Nuts are made. *As a flyer would want them made*—taking care that these parts should have no flaws and should be completely dependable.

"Unbrako" Internal Wrenching Bolt (far left), and 100° Flush-Head Socket Bolt (left) are made to extremely close tolerances, and possessed of extraordinary tensile strength.

NATIONAL AERONAUTICAL STANDARD

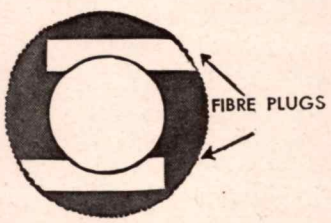


FIG. 1

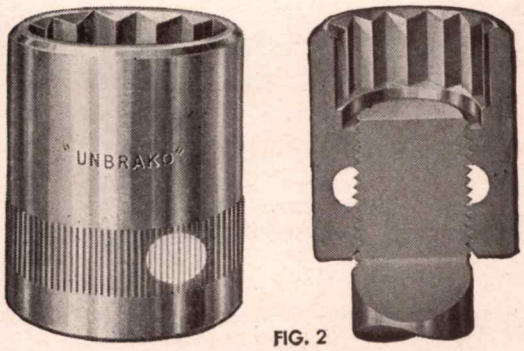


FIG. 2

"Unbrako" Internal Wrenching Lock Nut has two fiber plugs to provide a dependable locking grip. Inserted through the body of the nut (Fig. 1), these plugs contact four threads of the bolt (Fig. 2), thus assuring a greater locking grip. These "Unbrako" Lock Nuts can be used almost indefinitely before the torque falls below the Wright Field minimum.

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SKYCYCLING AS EASY AS BICYCLING? It all depends on knowing how. And Piper says it will be easy to pick up the "know how" of flying this new type Cub Skycycle.* But whether you fly the skyways or drive the highways, there's *new* Sinclair Gasoline power-packed with 100-octane components to help your motor do its utmost.

*(20 ft. wing spread, 16 ft. fuselage)

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CAR CARE—*OR ELSE!* With fourteen million eager buyers awaiting new cars, figure your chance. Then you'll agree it's wise to nurse that old car. SINCLAIR-IZE service saves wear. See your Sinclair Dealer today.

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DIGEST OF THE NEWS

National Oklahoma Aviation Clinic in Firm Stand on Many Urgent Issues

Topics Include Unified Defense, Return of Airports, Federal Aid and More Encouragement of Private Flying

A bright future for aviation (if the industry remains progressive and alert) was predicted by speakers in the Third National Aviation Clinic at Oklahoma City, Okla., Nov. 19-21.

Warning signals were sent up, however, that the industry may be retarded by a flood of regulatory laws if it does not work to secure popular support giving the best and safest transportation service possible at reasonable costs.

Among papers by approximately 20 speakers representing every branch of the aviation industry, were noonday luncheon addresses by Lt. Gen. Ira C. Eaker, deputy commander U. S. Army Air Forces, on "Winning Strategies of Aerial Warfare," and by Admiral Mark A Mitscher, U. S. deputy chief of naval operations, on "The Atomic Fleet." These and other military leaders were introduced to the clinic and given enthusiastic receptions.

A resolution, unanimously adopted, urged immediate establishment of a national Secretary of Defense, with three under-secretaries of Army, Navy and Air, respectively, this in recognition of the fact that air power, through its record in World War II, has earned its rightful place as a separate and distinct arm of our unified combat command.

An accompanying resolution recommended creation of a National Defense Information Service Center, the clinic expressing its opinion that a proper agency to set it up would be the National Aeronautic Assn. which already has formulated plans to that end.

In view of the cessation of hostilities in both European and Pacific theatres, the clinic asked for immediate end to control of civil aviation activities by the Interdepartmental Air Traffic Control Board, and the return of such control exclusively to the agencies established by statute for that purpose.

A strong stand was taken for earliest possible release and disposal of surplus military and civil airports, facilities and equipment. Pending such disposal, federal authorities were asked to issue interim permits that state and local government agencies may immediately resume the use of airports turned over to the Army and Navy during the war.

George Bosari, of the Surplus Property Administration, explained to meetings presided over by Pat Moore, Peoria, Ill., secretary-treasurer of the American Assn. of Airport Executives, that such return was provided for in regulations of his agency. He said that state or local governments must give 30 days notice of their intention to have returned, to purchase, or to lease, airport facilities, and they will

(*Continued on page* 142)

N. Y. Survey Confirms Air Travel Expansion

An aviation spot survey among New York business concerns, just completed by the Commerce and Industry Assn. of New York, reveals a possible 50% increase in domestic passenger transport, more travel to South America and Europe, wider-spread freight shipments by air, and the probable acquisition of fleets of small planes by business concerns.

In the passenger field the outstanding facts to emerge were that air travel is not used more frequently because 46.6% of those replying to the questionnaire feared for their safety, and 8.6% reported that their families objected.

Replies showed that 13% expected to purchase from one to twenty planes, ranging in capacity from two passengers to twelve and costing from $4,500 to $25,000 each, 70% of the planes to be used for passengers only, 10% cargo only, and 20% for both passengers and cargo.

Airlines Seek Cargo Business by 13% Cut in Carrier Rates

A 13% reduction in air express rates, from the present basic 70¢ to 61 2/5¢ per ton-mile, has been agreed upon by nineteen domestic carriers to begin Jan. 1. The declared purpose is to promote greater use of this form of cargo transportation.

The cut, according to the Air Transport Assn., will not affect the authorized special charge on perishable items, and the minimum charge of $1 per consignment will continue. Coast-to-coast rates will drop from 84¢ to 73¢ per pound. Lower tariffs maintained by four lines for bulk shipments will remain unchanged, and two carriers heretofore outside this category have declared their intention of introducing a supplementary all-cargo service.

Reductions of 40% in air express commodity rates, applying to northbound shipments of cut flowers, cut ferns, fruits, seafood, unprocessed decorative greens and vegetables, have been put into force over most of the Eastern Air Lines system serving approximately 60 cities.

For all the companies concerned, however, the rates will affect a total of at least 750 shipping points.

Air express observers anticipate that the reduced rates will result in a greatly increased use of air express by shippers and consignees of perishable commodities.

PROTEST SHIFT IN NEW YORK AIRPORTS

Briggs of Northeast Wants to Stay On at LaGuardia

Mayor F. H. LaGuardia's order for Northeast Airlines, Pennsylvania - Central Airlines, Northwest Airlines and National Airlines to remove from New York's LaGuardia Airport to Idlewild as soon as the new field is opened to receive them, has met with a sharp protest from William B. Briggs, vice-president of the first-mentioned carrier.

Briggs declared that moving into Idlewild, which is twice the distance from Manhattan of LaGuardia's eight miles, will set the four companies concerned back two to three years in their operations. For one thing, he said, mail and express business will suffer in that such items will be channeled into the more convenient transports remaining at LaGuardia.

The controversy has had repercussions in political circles of New York's borough of Queens, a councilman who has just been elected there proposing at a Board of Estimate meeting that work on the 90-million-dollar Idlewild Airport be discontinued and that the remaining funds be diverted to construction of schools.

In the meantime airlines serving New York are interested in facilities at the Newark Airport which has just been returned to civilian use by the U. S. Army.

Flying Farmers Form National Organization on Oklahoma Pattern

A National Flying Farmers Assn. was organized at a meeting in Oklahoma City, Okla., November 21, following adjournment of the National Aviation Clinic. National headquarters will be at Stillwater, Okla.

The Oklahoma Flying Farmers Assn., which called the meeting, voted to sponsor the new organization until it gets on its feet, and pledged itself to become the first state chapter.

Insurance Premiums Go Down as Underwriters Approve Air Travel

Institute Survey of 100 Leading Companies Upholds Recent Advances in Airworthiness

Approximately 50 life insurance companies, representing 80% of the organizations in that field and interviewed by the Institute of Life Insurance of New York, have just indicated that world-wide airline passenger travel without limitation is now regarded as a standard risk in the issuance of new life insurance policies.

A limited amount of world travel, usually about 50,000 miles annually, is regarded as standard by 10% of the companies surveyed, making nearly 60% which now place no underwriting limitations on normal intercontinental air journeys. Only 10% of the companies now turn down applicants who contemplate such travel, or issue policies excluding this risk.

Pilots and crew members, on flights in the U. S. and Western Hemisphere alike, may now take out life insurance at an extra premium, usually $5 per $1,000, with all but 15% of the companies. Prior to the war, only about one-third of the companies insured such applicants, and the extra premium was then usually $25.

Insurance for those using private pleasure planes has also been liberalized. Travel as passengers in such planes, with a limit usually specified at about 5,000 miles annually, is regarded as standard by 60% of the companies. Only 15% refuse such applicants.

Brazilian Agency Seeks Aviation Teachers for School at Sao Paulo

The John Paul Riddle Co., Miami, Florida, is seeking trained instructors for aviation technical positions in Brazil, according to an announcement by vice-president Carl R. Anderson.

Accepted applicants will go to headquarters in Sao Paulo, where John Paul Riddle operates the national technical aviation training school, Escola Tecnica de Aviacao, for the Brazilian government.

Available positions are in some 67 categories, ranging from teletype operators to air force administrators.

Each accepted instructor-candidate, before being sent to Brazil, will matriculate at the Riddle Aviation Instructors School in Miami for 14 weeks, being taught Portuguese, desired teaching techniques, and about Brazil.

Nat'l. Machine Tool Builders Elect Next Year's Officers

William P. Kirk, vice-president, Pratt & Whitney Div. of Niles-Bement-Pond Co., has been elected president Natl. Machine Tool Builders Assn. for the ensuing year. Associates: H. Pease, first vice-president, A. G. Bryant, second vice-president, and Richard E. LeBlond, treasurer.

George Wardman

To Assist R. L. Cummings

George F. Wardman, former aide to John C. Cooper, who recently retired as Pan American vice-president, has been appointed assistant to Robert L. Cummings, manager of Pan American Atlantic Division.

Wardman joined the organization in 1936. He has served as traffic representative in Bermuda and airport traffic manager at Foynes, Eire.

Two old friends in business reunion—Rickenbacker and Martin

Eastern Orders 50 Martins at 10-Million Dollar Cost

Capt. Eddie Rickenbacker, president and general manager of Eastern Air Lines, Inc., has just signed an order for a fleet of 50 36-passenger transport planes of the newly designed twin-engined Martin 202 type, to cost more than $10,000,000.

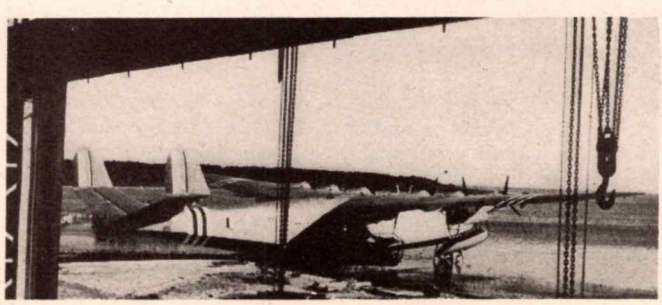
Present at the signing was Glenn L. Martin, president of the Glenn L. Martin Co., who gave Capt. Rickenbacker his first airplane ride at Riverside, Calif., in 1913 when Capt. Rickenbacker was a racing-car driver.

The new 202's will increase the present Eastern Air Lines fleet, which will have 56 Douglas DC-3 *Silverliners* in Jan., 1946, to nearly 100 multi-engined transport planes. There will be delivery of 20 4-engined 56 passenger *Skymasters* early in the spring of 1946, and 20 4-engined, 50-62 passenger Lockheed *Constellation* liners in the summer.

U. S. Dept. of Labor Announces Upswing in Apprentice Training

The Department of Labor announces that 6900 industrial plants have adopted apprenticeship programs since VE-Day.

In setting up these programs, field representatives have worked closely with employers and labor in an effort to overcome shortages that are already becoming evident in the market for skilled labor.



Giant 75-ton, 100-passenger, French seaplane, the Latercoere "631." The parts were concealed in Southern France until the Liberation

GENERAL ELECTRIC NEW FLIGHT TEST LABORATORY

General Electric's Flight Test Division is building a new hangar of unusual design. The building is to be entirely of poured concrete, the forms and scaffolding are mounted on wheels and will be moved forward as the pouring of each section is completed The hangar will be 160 ft wide, 175 ft deep, and 45 ft high in the center, or large enough to house four B-24 bombers.

Development and test work on all types of jet and gas turbine engines, radar, aircraft instruments, and electronic aircraft equipment will be carried on in laboratories adjoining the hangar which is located at the Schenectady County Airport.

Super-Committee for AIA

A joint technical board will henceforth coordinate the interests of technical committees of the Aircraft Industries Assn. Members are: Wellwood Beall, Boeing Aircraft, representing the aircraft technical committee; Wright Parkins, Pratt & Whitney, acting for the engine technical group; Erle Martin, Hamilton Propellers, for the propeller technical committee; and R. P. Lansing, Bendix Aviation, representing the accessory and equipment technical committee.

Resume Plastics Show

The first post-war Plastics Show will be held in Detroit's Convention Hall Jan. 7 through Jan. 11, 1946.

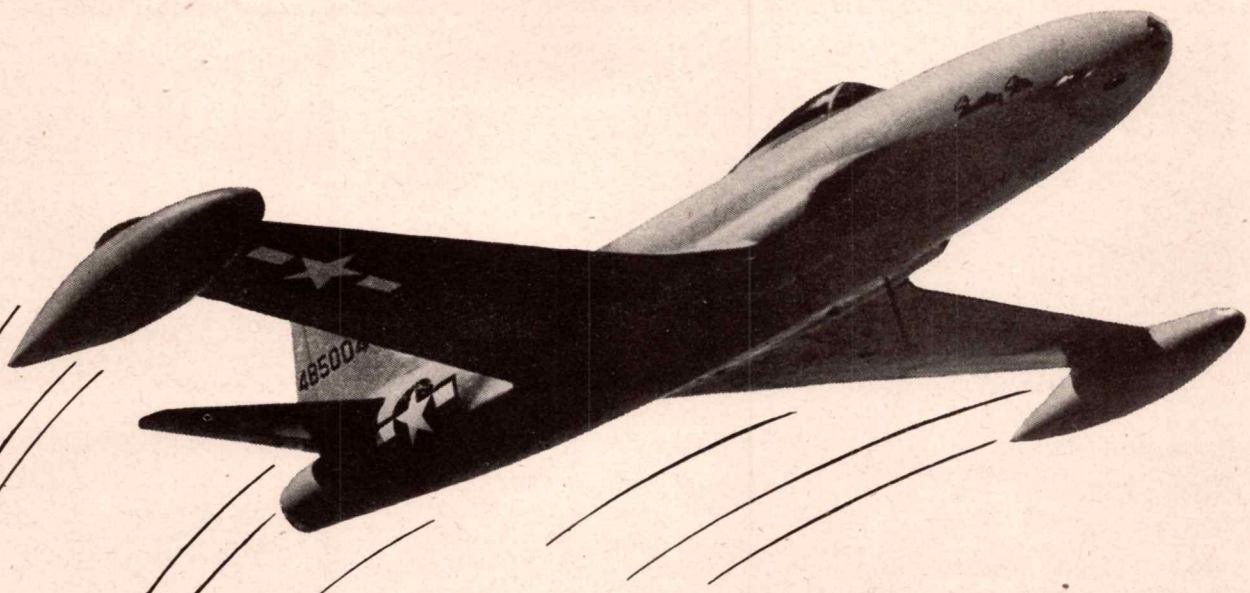
The Society of Plastics Engineers Annual Meeting, held in conjunction, will include lectures concerning new developments in materials, molding technique, product design, laminates, tool design, coatings, and consumer specifications.

City of Flint Contracts for an Improved Airport

Giffels & Vallet, Inc., Detroit engineers, have been awarded the City of Flint, Mich., contract for an over-all airport plan. The assignment signifies the 89th airport project on which this firm has been engaged, others current being port projects for Toledo, Ohio, and Ann Arbor and Pontiac, Mich.

The undeveloped airport at Flint was recently turned back to the city after several years' occupancy by the Army Air Forces. At present listed as in Class 3, the field will be expanded into a Class 4 airport.

Let's talk on a new plane . . .

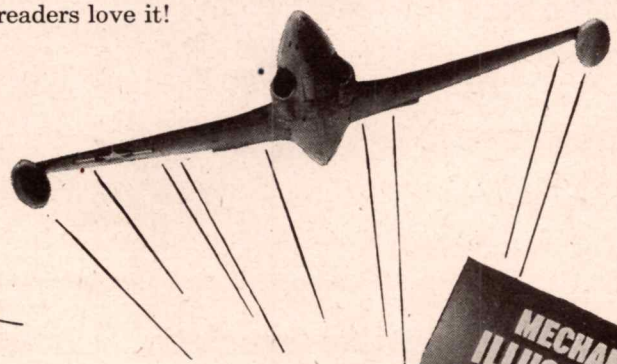


The best place for you to talk about your new plane is in Mechanix Illustrated. You'll be talking to flyers.

Mechanix Illustrated is filled with plane talk for fellows who fly and who want to. Every issue has a lot of articles about private planes and piloting. In the November, 1945, issue—just as an example—there were features about small planes with jet-assistance, gyro-cars for the near future, and the new civil air regulations. Articles like these are priming your market and building runways for fast sales tomorrow.

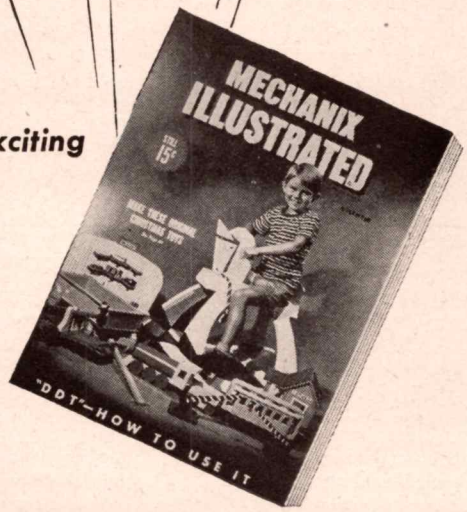
Mechanix Illustrated is the "how to fly, how to buy, how to care for" magazine of plane excitement.

Flyers and flyers-that-will-be get a big lift out of such unforgettable stories as Herman "Fish" Salmon's "I Ride the Shooting Star," in the October Mechanix Illustrated. Salmon test-piloted the latest jet-propelled plane—swift as sound, quiet as a ghost, dangerous as a chicken hawk. It's authoritative stuff, and readers love it!



The magazine that Makes plane Facts exciting

Mechanix Illustrated readers are a bunch of "nuts" about flying. They *use* the magazine to answer their personal aviation questions. Mechanix Illustrated never leaves them up in the air. Right now this greatest bunch of coupon clippers in the country wants the newest that's known about flying. They're getting it in every issue of Mechanix Illustrated—getting it first, getting it straight. Reach your *interested* market by putting *your* plane talk in Mechanix Illustrated.



Fawcett Publications, Inc., 295 Madison Ave., New York 17, N.Y.

World's Largest Publishers of Monthly Magazines

Pan American World Airways flight crew in front of DC-4 in which they made survey flight of South America-Africa route

Cincinnati Schotts Take Over Cleveland Pneumatic Tool

Walter E. Schott, spearhead of the Cincinnati family of that name, has been elected a director of the Cleveland Pneumatic Tool Co. and its wholly-owned subsidiaries, Cleveland Pneumatic Aerol, Inc. in Euclid, Ohio and Cleveland Pneumatic Tool Co. of Canada, Ltd. in Toronto, Ontario. Harold C. Schott has been made a director and vice-president.

This action followed the acquisition one week previously by the Schotts and their associates of the preferred stock and better than 97% of the common of the parent company, for $4,150,000.

Additionally, Wendell A. Falsgraf, Harry C. Burns, and Coleman Harris were elected to the board. Present directors, president George P. Torrence, vice-president and treasurer John S. Clark, chief executive engineer John F. Wallace, and special representative E. W. (Pop) Cleveland will remain on the board.

Two Airfields for Private Flyers in New York City

The selection by New York City of two outlying sites for municipal airports marks a definite step in providing facilities for private flyers.

As announced by Mayor LaGuardia, two tentative sites, in the Bronx and on Staten Island, have been selected after a series of studies that involved problems of traffic trends, convenience to the public, and the desire to insure air safety.

With these in view each field is to be located as far as practicable from LaGuardia and the new airport at Idlewild.

Bonnalie Heads Mexican Subsidiary LAMSA to Link with United at San Diego

Allan F. Bonnalie, whose aviation career dates back to 1911 and who served in World Wars I and II, has been named president and general manager of Lineas Aereas Mexicanas, S. A. (LAMSA), Mexican subsidiary of United Air Lines. He succeeds William A. Taylor, resigned.

Ease Over-Border Traffic

Inter-American private plane traffic will be facilitated through an order by T. P. Wright, Administrator of Civil Aeronautics, simplifying issuance of flight permits. It is expected that tourist traffic from Mexico will benefit particularly.

CAA inspectors at border areas are authorized to issue permits for flights within the United States by foreign civil aircraft not carrying passengers or cargo for hire, or mail. Previously, permits could be obtained only from Washington.

More Cooks to Stir Government Pot Revealed in Congressional Report

Another Government steering-group for aviation, operating secretly since its organization March 27, has just come to light in its report to the O'Mahoney subcommittee on aircraft demobilization.

The group, known as the Air Coordinating Committee, is composed of top aviation experts in the War, Navy, State and Commerce Departments and in the CAB. Its secretary is Myron A. Tracy, former acting director of the Aircraft Resources Control Office. Present committee interests are said to be in foreign air relations of the U. S., demobilization of the American air industry, and post-war aviation developments in the public interest.

It is expected that this new Air Coordinating Committee will absorb the Inter-Air Traffic Control Board and will become a permanent body at Washington.

Officials of Halfco, organization newly-formed to manufacture spherical, self-aligning bearing. L. to r.: A. L. Spangberg, inventor of bearing, Fred Silva, and Dillon Stevens, Halfco president

Airplane Charter Service Out of Sky Harbor Airport Chicago, Ill.

Airplane charter service for business executives, sportsmen and for emergency travel has been inaugurated by the newly organized Central States Aviation, Inc., from Sky Harbor Airport, Wheeling, Ill.

The concern has purchased a fleet of twelve twin-engine, four-passenger *Cessna* planes which are being rebuilt and reconverted for luxury air travel.

Buccaneer Promotes Three in General Operations

National Airlines, Jacksonville, announces the advance of three NAL veterans.

D. H. Amos, formerly assistant vice-president in charge of operations, has been appointed personnel manager.

L. W. Dymond, chief flight superintendent for National, is now assistant to the vice-president in charge of operations.

P. A. Williams has been appointed assistant chief flight superintendent.

Trade Group Conducts Air Freight Survey of Greater New York Area

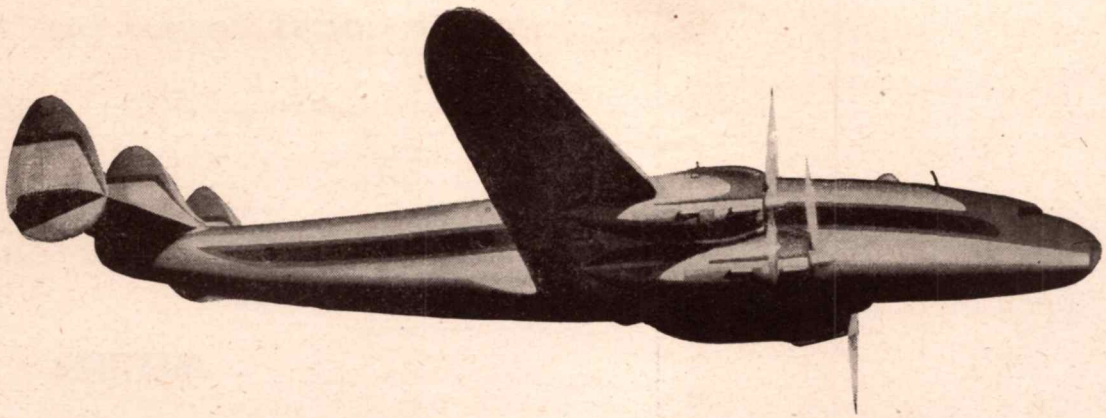
Fifteen important groups, including a number of regional chambers of commerce together with the U. S. Dept. of Agriculture, the New York University Graduate School of Business Administration and the Port of New York Authority, have begun a survey of potential air freight likely to be flown from the metropolitan area of Greater New York and northern New Jersey to San Francisco and Miami.

Initiating and conducting the inquiry is the foundation known as Edward S. Evans Transportation Research operating from offices of the New York Board of Trade. This benefaction was established by the late Col. Edward S. Evans, former president of the Evans Products Co. of Detroit, for the purpose of carrying on independent investigations for the betterment of public carriers.

The present survey is eliciting its materials for analysis through a questionnaire which asks the business man approached to answer three questions primarily: (1) how many pounds per month he would be likely to ship to San Francisco; (2) how many he would send to Miami; and (3) what general class of merchandise he would probably consign to both places. Three additional questions are provided for firms which would use the facility for shipment of relatively small articles of high value.

North American Aviation Yields Kansas City Plant

As an important step in reconversion North American Aviation has leased to General Motors its entire plant at Kansas City, Kan., for use in automobile assembly. General Motors had previously intended building a new structure for this purpose in the same area.



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FRENCH GOVERNMENT AIRLINES

ROYAL DUTCH AIR LINES (KLM)

NETHERLANDS INDIES AIRLINES (KNILM)

PAN AMERICAN WORLD AIRWAYS

PAN AMERICAN-GRACE AIRWAYS (PANAGRA)

TRANSCONTINENTAL & WESTERN AIR (TWA)

THE NEW AIRLINE STANDARD

Lockheed Constellation

Look to Lockheed for Leadership LOCKHEED *Years Ahead in the Science of Flight*

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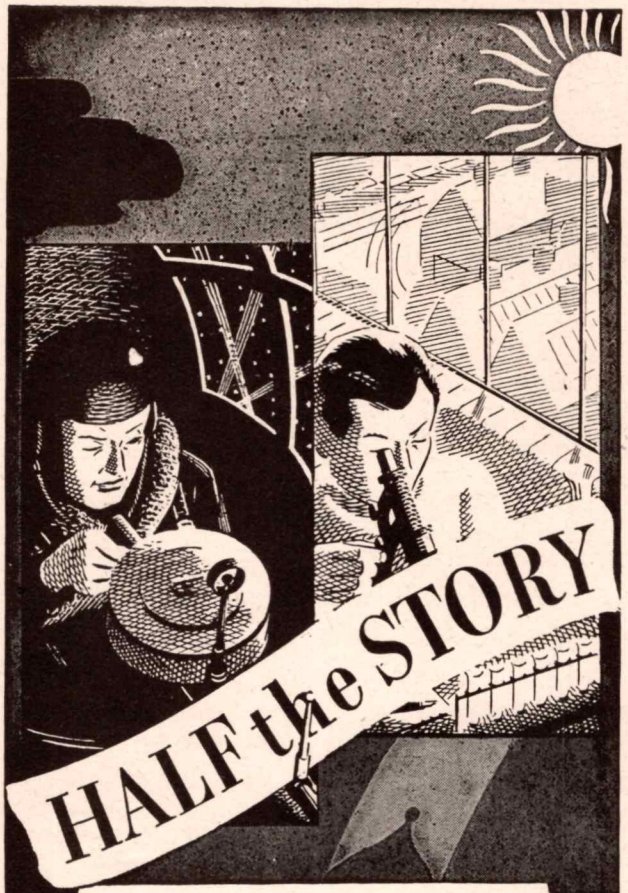

AT the moment only half the story can be told. But, with the return of Peace, we hope soon to be able to tell you of the war developments which will be incorporated in the future design and manufacture of our Optical — Mechanical — Electrical Instruments and Aircraft Equipment.

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AVIMO

PROGRESS by QUALITY

Pacific Coast Round-Up

United States Aviation Corp. has been formed in California by Lt. Col. Brown USMC of Oakland, Major Joseph R. Hargrove AAF of San Bernadino, Lt. Mal Eno USMC of La Jolla, Ronald Eno of Colorado Springs, Col., and Howard Payne of Washington, D. C. Long Beach Municipal Airport, at Long Beach, is the operating base.

A new entrant in the lightplane field is Puget Pacific Planes, Inc., Tacoma, Washington, headed by James A. Edman with Donald J. Wheeler as chief engineer, both formerly of Boeing Aircraft at Seattle. The concern will offer a complete line of personal aircraft bearing the name "Wheelair."

Engel Aircraft Specialties, of Escondido, Calif., is again making manifolds, wheel pants, cowls, spinnings and various other items for commercial aircraft.

Ryan Aeronautical Co. of San Diego will act as RFC agent to sell Ryan-built spare parts for the Ryan ST-3KR airplanes (Army PT-22's) in current use.

Aero Design and Engineering Corp. of Culver City offers, to California residents only, 60,000 shares of its $1 par value common stock. The corporation is presently engaged in developing a light twin-engine, all-metal, transport-type airplane for feeder-line, executive and charter service.

By a vote of five to one, city voters have approved a $20,000,000 bond issue to finance expansion of the San Francisco Airport.

The program, developed by B. M. Doolin, superintendent of the municipal flying field, and consulting experts, calls for extension of runways to 10,000 ft.

Pacific Coast private flyers may soon add to their air map two fields in the vicinity of Oakland, developed at a total cost of more than $4,000,000. The areas, Hayward Army Air Field and Concord Army Air Field, have been declared surplus by the U. S. Army Air Forces.

Military airmen applying at the Oakland CAA area offices for commercial pilot certificates increased to 500 a week in November. The total of certificates issued by the Oakland offices since June has passed the 5000 mark.

Naval Air Transport Service headquarters at Oakland Airport has inaugurated twice-daily service to Shanghai, China, via Okinawa and Tokyo, and has announced new schedules to the Atlantic Coast to relieve transportation bottlenecks caused by the mass return of military personnel.

MEETINGS

Dec. 16-17—International Aviation Day, El Paso.

Dec. 17—Wright Brothers Lecture, Institute of Aeronautical Sciences, Washington, D. C.

Dec. 17—National Aeronautics Assn. and Aero Club of Washington Banquet.

1946

Jan. 4-5-6—All-American Air Maneuvers, Florida Air Races.

Jan. 7-11—SAE annual meeting and engineering display, Book-Cadillac Hotel, Detroit

Jan. 8—IATA North Atlantic rate conference, New York

Jan. 11-20—Cleveland Aircraft Show

Jan. 21-22—Northwest Aviation Planning Council, Boise Hotel, Idaho

Jan. 28—Institute of Aeronautical Sciences, honors night dinner, Waldorf-Astoria Hotel, New York

Feb. 12—IATA European Rate Conference, Paris

Feb. 21—IATA Middle East Rate Conference, Cairo

March 1-5—Pan American Aircraft Exposition, Dallas, Texas

April 3-5—SAE National Aeronautic Spring meeting, Hotel New Yorker, New York

National Aircraft Show January 11 Through 20 at Cleveland Auditorium

The National Aircraft Show will be in full swing at the Cleveland Public Auditorium Jan. 11 through 20.

Each day, during the run of the show, outstanding celebrities, aviation leaders, aces, and Army Air Force and other government officials are to appear as principal speakers at luncheon and dinner meetings in Cleveland's hotels; and these visitors are also to address the public from the main stage of the National Aircraft Show.

The event has been organized and will be conducted by the National Aircraft Show Co., with proceeds going to the Army Air Forces Aid Society.

Expect 1200 Private Planes in Gulf Oil's 5th Avacade

To stimulate cross-country flying in light planes, Gulf Oil and participating aircraft manufacturers announce renewal of the Annual Light Airplane Tour to Florida to be held this winter from Dec. 26 to Jan. 20. The event is open to owners of light airplanes with engines not exceeding 125 hp. Free gasoline and oil at more than 50 specified airports on routes to Florida and back will be furnished by Gulf during the period.

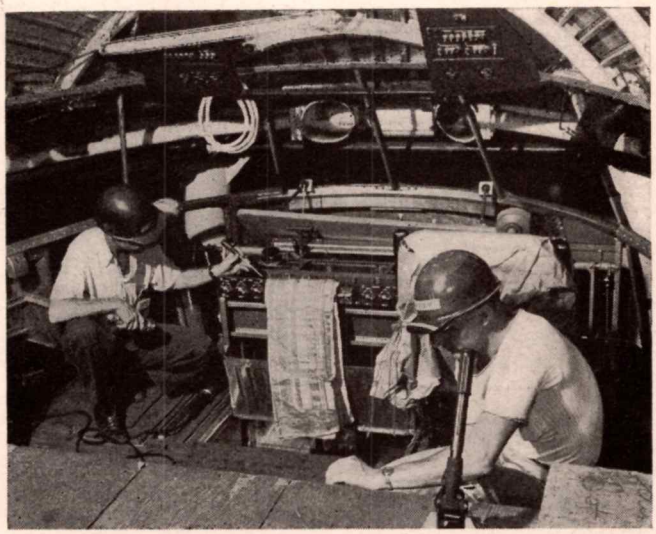
It is expected that no fewer than 1200 private planes from all Eastern states will make the flight, 1400 having made the last previous tour in 1941.

Explaining the change of the tour from mass flights, begun in the first aircade in 1937, to individual flights in the current outing, Maj. Al Williams, manager of the Gulf aviation dept., said:

"When we originated the first air tour over Gulf Airways in 1937, the planes gathered at specified points along the way and were guided to their destination by wing leaders. Despite the success of that venture, we did not think it had entirely served its purpose in that the participants did not fly under conditions comparable to those which would be encountered should they set out on a cross-country flight alone.

"As a result of our experience subsequent tours were organized so that no mass flights would be made. In addition to more fully accomplishing its purpose, this method of handling eliminated mass arrivals at the various ports along the way. It simplified the service, and it eliminated almost completely the overtaxing of sleeping and eating facilities."

Manufacturers participating and to whom inquiries concerning eligibility should be sent, are: Aeronca Aircraft Corp., Globe Aircraft Corp., Luscombe Airplane Corp., Piper Aircraft Corp., Taylorcraft Aviation Corp., Stinson Div. of Consolidated Vultee Aircraft Corp., Engineering and Research Corp., Culver Aircraft Corp., Commonwealth Aircraft, Inc., Funk Aircraft Co., and Harlow Aircraft Co.



Consolidated B-24 delivered to General Electric to serve as flying laboratory for aircraft electronic equipment

Build "Canuck" at $3000

Fleet Aircraft, Ltd., near Ft. Erie in eastern Canada, has begun production of a line of light-planes including the Fleet *Canuck*, a single-engine craft in the 1400-lb class, designed to sell at approximately $3000. It will carry two passengers. The cruising speed, using a 75-hp engine, is 100 mph or an estimated 25 miles to the gallon of gas.

William Blees to Vultee

William A. Blees, former vice-president and Pacific Coast manager of Young and Rubicam advertising agency, has been appointed vice-president in charge of sales for Consolidated Vultee Aircraft Corp., according to an announcement by Harry Woodhead, president.

William A. Blees

Correction

In the November 15 issue an announcement of the election of R. P. Tyler, general sales manager, to the board of directors of the Macwhyte Co. of Kenosha, Wis., was inadvertently transcribed to read that he had been made president. Of course, the president is and continues to be Jessel S. Whyte. Apologies to both gentlemen.

BAD WEATHER AGGRAVATES TOWER SHUTDOWN THREAT

CAA Appeal for Continuation Funds Unavailing as Withdrawing Armed Forces Promise Investigation

Recent adverse weather conditions, causing the grounding of passenger planes in airports at Washington, Baltimore, Philadelphia, Atlanta, New York and Boston, have pointed the urgency of an appeal just made to the Armed Forces by the CAA for a supplemental appropriation for maintenance of 105 air traffic control towers throughout the U. S.

Nov. 12, at LaGuardia Airfield in New York, 500 incoming and outgoing flights were cancelled, and Gen. Dwight Eisenhower, returning from the former European war theatre, was obliged to land at the Squantum Naval Air Station in Quincy, Mass., instead of at Boston Airport. The following day the number of cancellations at LaGuardia totalled 648—328 outbound and 320 incoming.

Stuart Tipton, president of the Air Transport Assn., declared that, as far as civil aviation is concerned, there will be no compromise with safety. "We will not go in for all-weather flying," he declared, "until we have the equipment and until our airline pilots have mastered it."

Approximately $1,500,000 will be required to continue CAA personnel at 90 towers during the first six months of 1946, said T. P. Wright, Administrator of Civil Aeronautics. Unless funds can be obtained speedily, he stated, the CAA will be forced to terminate the operations it has been conducting since 1942 at those towers from which Army or Navy sponsorship is being withdrawn. Those municipalities desiring continuation of the CAA operation in such cases will thus have to bear the cost of tower staffing, Mr. Wright added, or do without it. CAA is currently urging the Armed Services to continue sponsorship of these operations until funds are made available.

Mr. Wright pointed out that the CAA, foreseeing the withdrawal of the funds when military flying tapered off, requested appropriations in 1943, again in 1944, and again in 1945, which would permit it to continue the operations in such event. These requests, however, were disapproved on the assumption that there would be ample time in which to make a thorough study of the operations before the situation assumed emergency proportions.

The CAA in its 1947 budget presentation has requested an appropriation of $3,121,000, which if approved would permit it to staff the air traffic control towers at 110 airports. These would include 90 of the 105 towers now serviced by the CAA through funds provided by the Armed Services. While 15 of the existing facilities would be discontinued because of insufficient traffic as a result of the decrease in military activity, 20 new locations would be added to cope with the airline traffic engendered by new routes and increases in scheduled flying.

American Equipment for Royal Dutch Airlines

In preparation for the inauguration of daily air flights from the Netherlands to the East Indies, the Royal Dutch Airlines have bought 14 Douglas DC-4 transports, each ship to accommodate 41 passengers and making the trip in four days. For its European service, the lines have ordered four Lockheed *Constellations*, each carrying 52 passengers. KLM's air terminal at Schiphol Airfield, near Amsterdam, has been rebuilt and is ready for use.

Oklahoma Clinic

(*Continued from page* 135)

then be given first priority to re-acquire such properties after they have been declared surplus. He explained that up to the time of the clinic 78 airports had been declared surplus, but that no final disposition had yet been made of any. He stated that such disposition probably could start within two or three months.

The clinic asked Congress to authorize political subdivisions through which federal agencies might be assessed reasonable charges for use of civilian airport facilities, and asked further Congressional support of CAA efforts to secure federal funds for airport traffic-control tower operation.

Acting on complaints from some delegates that private flyers are being denied use of some of the larger air terminals, a resolution was proposed from the floor and adopted, asking that municipal airport managers distinguish between transient and transport personal flying, as contrasted with training or student flying, and that, in the event of an overcrowding of main airport facilities, outlying airfields be provided or assigned for practice flights.

National and state legislation to provide for joint ownership of airports in different states, and to exempt them from taxation, was requested in a resolution presented from the floor and adopted.

Clashes between private flyers and airlines delegates occurred over a resolution which proposed that wartime exemption from regulation of charter and non-scheduled operators be continued for from 3 to 5 years. Replying to charges by some delegates that the big airlines were trying to discourage private flying, several airlines delegates denied the accusations but declared that they believed 3 to 5 years was too long a time to ask for retention of present exemptions, as no one could tell what modifying conditions might arise within the periods specified. The compromise resolution finally adopted mentioned no specific time, but requested continuation of the present exemptions until federal authorities make clear what kind of regulations for private and non-scheduled flyers they have in mind.

Along lines of education and civil pilot training, the Clinic favored action by NAA in coordinating aviation educational activities, through establishment of a committee representing appropriate educational interests. It also urged Congress to provide for a permanent program of civil pilot training.

As a safety measure the clinic recommended that the CAA and state areonautics commissions expedite a program of uniform air markings.

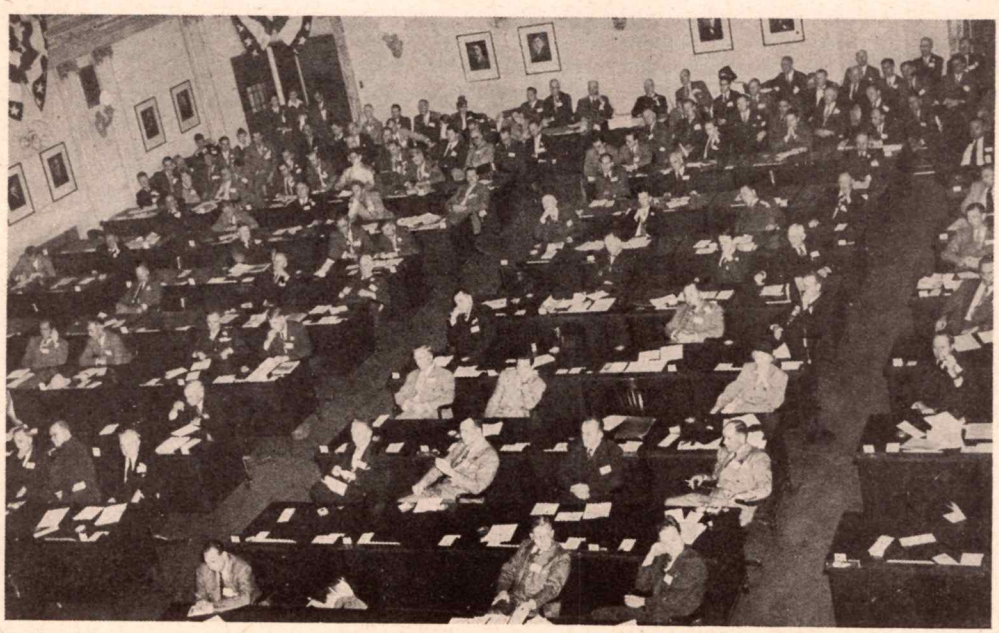
Continuance and expansion of intensive research in all aspects of civil and military aviation, by both government and private enterprise, was declared by the clinic to be essential to national security and welfare.

The nation's military establishment, including Army, Navy, and Air Forces, was praised in papers and discussions for its part in winning the war.

It was announced that the 1946 National Aviation Clinic will be held at Oklahoma City, October 14-16, sponsored by the National Aeronautic Assn. and the Oklahoma City chamber of commerce.

Brig. Gen. John A. Allard, right, former vice-president of Curtiss-Wright, with Lord Halifax and Lt. Gen. James H. Doolittle after being made Honorary Commander of Order of British Empire in recognition of service as Chief of Staff, Eighth Air Force

Delegates attending Third National Aviation Clinic in House of Representatives Hall at Oklahoma City State Capitol. Closing day photo shows that most of the delegates remained to end of the session



FINANCIAL

General Motors Corp.—net income for first half of 1945 was $36,791,784, due to a $9,612,000 income tax credit and a $24,026,800 special income credit derived from post-war reserves and utilized to absorb costs of post-war reconversion. Profit equalled after preferred dividends 78¢ a share common.

Westinghouse Electric — cancelled war contracts and 20-day strike of several thousand salaried employees in six company plants show in production figures for first nine months of this year. Net sales billed were $518,869,515, a decrease of 15% over same period in 1944.

Wright Aeronautical Corp.—dividend of $6 a share, payable Dec. 14. Previous payment Dec. 22, 1944, $8 a share.

Allis-Chalmers Mfg. — Oct. 8 paid $30,000,000 on loans of $75,000,000 from twenty-two banks. Outstanding Oct. 31 were $9,000,000 in notes due next Aug. 10, and $31,284,774 of suspended maturity.

Transcontinental & Western Air, Inc.—earned $1,660,072 in nine months ended Sept. 30, after taxes and charges which included a non-recurrent item of $779,693, equal to $1.69 a capital share. Third quarter earnings showed 64¢ a share, against an average of 52.5¢ a share in the first half of 1945.

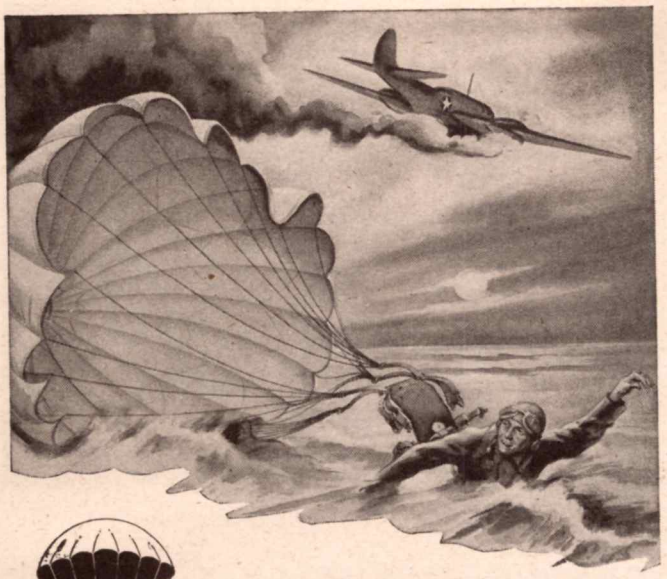
Aireon Mfg. Corp.—during fiscal year ended Apr. 30 net income after all charges (but before renegotiations), was $750,553, equal to $1.03 a share on 714,919 shares of common outstanding, compared with $1,064,041, or $1.49 per share, in 1943-4.

Air Associates, Inc.—dividend of 20¢ per share common, payable Dec. 8, declared by board of directors at Oct. 29 meeting.

Braniff Airways—carried 108,940 passengers in the third quarter of 1945, an increase of 46.84% over the same period in 1944. Revenue from all sources was $2,337,646.00 or 27.78% over the third quarter of 1944, or a net profit of $376,547.

Perfect Circle Co. — declared regular quarterly dividend of 50¢ on 162,500 capital shares, payable Dec. 31, 1945, to stock of record.

Celanese Corp. of America—net profit for quarter ended Sept. 30, $1,830,622, or, after preferred dividends, 73¢ per share. Earnings compare with $1,561,122, equal after preferred dividends to 56¢ a share in third quarter of 1944.



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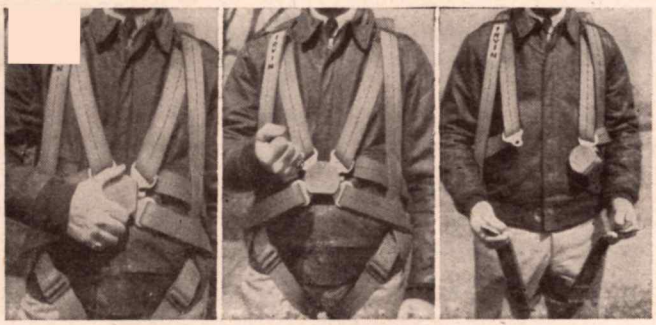
"SINGLE-RELEASE" Harness

UNITED NATIONS' FLYERS
are using it for
SAFER LANDINGS

A one-hand turn and a tap on the single frontal disk instantly releases the harness . . . leaving the flyer entirely free. Accidental release is impossible before disk is "set" for action.

All United Nations' Air Forces for years have used IRVIN as standard equipment . . . and now the Irvin "Single-Release" harness is acknowledged as superior for all landings. IRVIN, as always, leads in Safety.



Twist and Set *Tap for Release* *Harness Falls Off*

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Complete Factories in Buffalo, N. Y., Glendale, Calif. (1500 Flower St.), and Lexington, Ky., U. S. A.—Canada, England and Sweden . . . All Serving the United Nations' Air Forces.

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for the hard-to-do

When the assembly of your product requires a special fastener or cold-forged product, call on our consultant service to help you at no obligation to you. We are equipped to manufacture cold-forged specialties in a wide range of metals, sizes and designs, in large or small quantities. In most instances, too, you'll find that cold-forging your special part represents a saving.

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KESTER FLUXES INSURE *Solder Performance*

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STANDARD FOR INDUSTRY

Carl F. B. Roth

Alfred Marchev

Republic Will Make Franklins in Aircooled Motors Purchase

Republic Aviation Corp. has arranged to purchase the Aircooled Motors Corp. of Syracuse, N. Y., for the sum of $1,500,000. The acquisition brings to Republic all rights for manufacture of Franklin airplane engines, widely used by the Army in wartime and expected to be in many post-war lightplanes.

In addition to Republic requirements a current $2,000,000 backlog contracted for the Franklin engine includes orders from Bell Aircraft Corp., the Stinson Division of Consolidated Vultee, and the Army Air Forces.

Alfred Marchev, Republic president, will become chairman of the board of Aircooled Motors Corp. with Carl F. B. Roth remaining as president.

Groom Your Plane With

AEROGROOM*

Clean and polish Alclad metal, propellers, windshields, painted or lacquered surfaces with this sensitive and highly balanced product. AEROGROOM may also be used as a burnishing agent where a high luster is desired. A neutral emulsifying agent minus all harsh abrasives.

AUTOGROOM CO., Inc.

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WRITE FOR FREE HANDBOOK

AIRLINES

Pennsylvania-Central Seeks Extensions Between Chicago and Norfolk

Testifying on applications for route extensions which would provide non-stop service between Chicago and the cities of Cleveland, Akron, Youngstown, Pittsburgh, Baltimore, Washington and Norfolk, C. Bedell Munro, president of PCA (Pennsylvania-Central Airlines) declared that air service now being rendered by other airlines between these cities is largely incidental to transcontinental service.

Royal Norwegian Transport Plans U. S. Bi-Weekly Line

Royal Norwegian Air Transport a state agency of the Norwegian Government established in 1943, has applied to the CAB to operate to and from the United States.

The transatlantic course proposed follows the Great Circle, linking Oslo and Stavanger in Norway, with Chicago and New York via Reykjavik, Iceland, and Goose Bay, Canada. Routes via Foynes, Ireland; Lagens in the Azores; and Gander, Newfoundland; or to Gander from Prestwick, Scotland, have been submitted as alternates.

N. Y.-Cincinnati Non-Stop

Should CAB approve the recent application of Colonial Airlines, Inc. for a certificate to connect Cincinnati with New York directly by air, Colonial will offer those cities non-stop service for the first time.

On this same route Colonial proposes to serve the intermediate points of Pittsburgh and Reading, Pa.

First Commercial Non-Stop New York to Miami for NAI

Schedules filed with the CAB by National Airlines, Inc. call for non-stop service employing 4-engine Douglas DC-4 aircraft between Miami and New York and Tampa and New York effective Jan. 1, 1946.

Consult
PYLE-NATIONAL
FOR AIRPORT LIGHTING
INDUSTRIAL PLANT
FLOODLIGHTING
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CONDUIT FITTINGS • PLUGS AND RECEPTACLES • VAPORTIGHT FIXTURES

Write for Airport Lighting Manual, Bulletin 3105; Floodlight Catalog 2100; and Pylet Conduit Fitting Catalog 1100, giving complete specifications.

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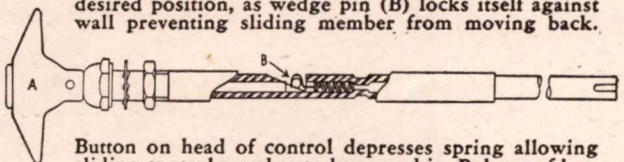
The R-5 Sikorsky Helicopter is equipped with an Arens Tension Lock Control as standard equipment.

NEW ARENS *Tension Lock*

A REMOTE CONTROL FOR DIFFICULT CONTROL JOBS

This compact, lightweight Arens Control, with all operating mechanism contained in the steel sleeve, will hold any load pressure which can be applied by hand. It can be used in combination with rods, cables, as well as flexible or rigid push-pull remote controls. It weighs only 8 ounces.

Merely pulling out control head (A) sets the control to any desired position, as wedge pin (B) locks itself against wall preventing sliding member from moving back.



Button on head of control depresses spring allowing sliding control member to be moved in. Release of button relieves compression on spring and locks control.

The new Tension Lock is one of many Arens controls. Other flexible and rigid remote controls, as well as standard and special head assemblies are shown in the Arens Catalog. Write for your copy today using business letterhead.

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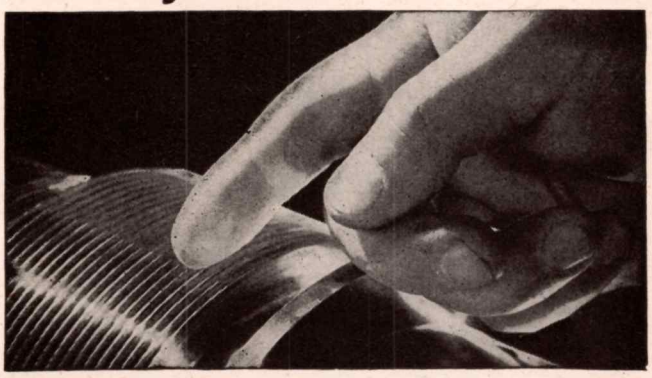
AS SURELY PERFECT CONTROL IS ARENS

NEW Synthetic Base Fluids



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- Free of chips, threads, sulphur base-cutting oil . . . right to the bottoms of the grooves . . . and temporarily proofed against rust, corrosion and hand soiling.
- By Solventol No. 27 . . . 40 to 1 with water . . . in a single stage of spray washing . . . with light air blowoff.
- This is revolutionary.
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- As confirmed in the leading war production plants.
- No. 27 can be used in most standard washers—or our complete engineering service will design faster, streamlined units for you.
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About People

A. E. Raymond

ARTHUR E. RAYMOND, Douglas Aircraft Co. will head the Institute of the Aeronautical Sciences for 1946, succeeding Charles H. Colvin of New York.

LEONARD M. ROSE has been appointed assistant to Benjamin F. Pepper, chairman of the board, TACA Airways. Col. Rose will be based in the New York office.

JOHN C. COOPER is retiring as vice-president and assistant to the president of Pan American World Airways in order to devote his time as member of the Institute for Advanced Study at Princeton on a research project having to do with the legal, political and economic problems of international air transport. He will continue as a member of Pan American's board of directors.

IVOR C. PETERSON has succeeded Eugene W. Norris as service director of the Aircraft Industries Assn. Norris resigned.

PAUL H. MERRIMAN, has assumed new duties as head of the Electrical and Electronics section of the Laboratories of The Glenn L. Martin organization.

RICHARD A. HOLMAN, for the past year Baltimore traffic manager of American Airlines, has been appointed personal administration manager, with headquarters in New York.

JOSEPH J. MITCHENER, JR., one of the founders and an organizer of the Feeder Lines Assn. and its former treasurer, has been appointed executive director.

F. J. BAUM, original project engineer on the Northrop *Black Widow* P-61 night fighter, has been appointed Dayton representative for Northrop Aircraft, Inc.

LT. COL. H. C. RANKIN has assumed the position of sales manager of the Beech Aircraft Corp.

METAL PROPELLERS
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OWNERS OF
PT-13, PT-17
AIRPLANES

HAVE YOUR *McCAULEY STEEL PROPELLER* MODIFIED AND RECONDITIONED FOR C.A.A. APPROVAL.

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CAA APPROVED TC-815

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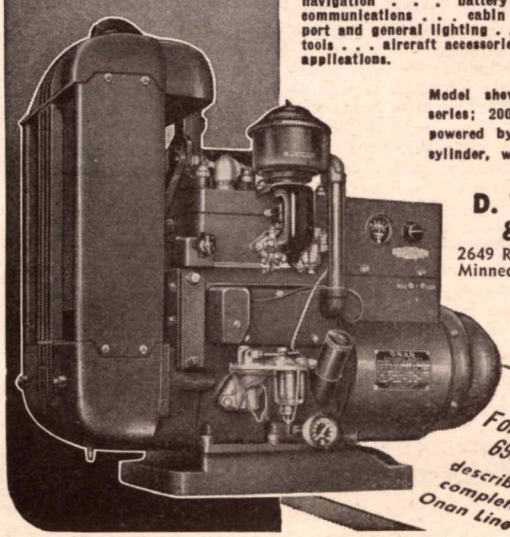
TO MEET AVIATION AND AIRCRAFT INDUSTRY POWER NEEDS

Models range from 350 to 35,000 watts, A. C. types from 115 to 660 volts, 50, 60, 180 cycles, single or three-phase and 400, 500 and 800 cycles, single phase. D. C. types from 6 to 4000 volts. Also available in dual voltage and special frequency types.

ONAN ELECTRIC GENERATING PLANTS provide power for many applications in the aviation industry. Available in 65 models including Airborne, lightweight, compact types. Powered by Onan-built gasoline engines, they are of compact, single-unit design. For heavy duty service, stationary or mobile.

Supply power for starter energizing . . . radio navigation . . . battery charging . . . communications . . . cabin heating . . . airport and general lighting . . . electrical repair tools . . . aircraft accessories . . . many other applications.

Model shown is from W2C series; 2000 to 3500 watts; powered by Onan-built, two-cylinder, water-cooled engine.



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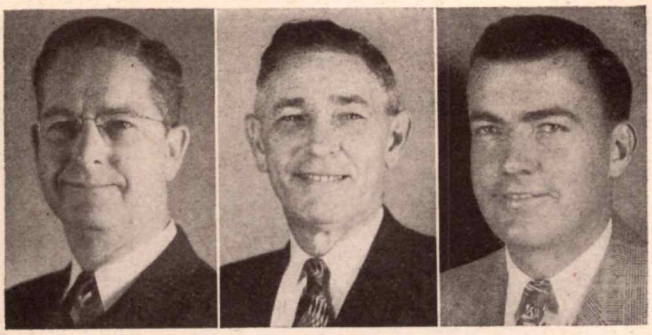
Write For Folder 690-A describing complete Onan Line



W. L. Wilkinson Dan Young W. H. Quade, Jr.

W. L. WILKINSON has become Solar Aircraft's new sales manager, and DAN YOUNG and WILLIAM H. QUADE, JR., have been appointed assistants.

RICHARD C. PALMER has been appointed special assistant to the president of Fairchild Engine and Airplane Corp.

CAPT. CHARLES S. VAUGHAN, of Manhasset, N. Y., has been appointed chief pilot of the Atlantic Div. of Pan American.

CAPT. JOHN RINGER, chief pilot for Air Cargo Transport Corp., has been elected vice-president of flight.

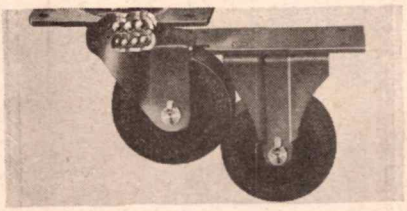
C. K. DWINELL, well-known hotel executive, has joined TWA as supt. of food service.

HAROLD A. OLSEN, newly promoted general traffic manager of PCA, will make his headquarters at the company's general offices at Washington, D. C.

LARRY S. ANDRICH has become vice-president and general manager of Snyder Tool and Engineering Co. of Detroit. GEORGE H. WHITEHOUSE became sales manager, assisted by GEORGE D. MELLING, JR., and WILLIAM F. POMEROY, sales engineers, and WILLIAM C. OBEREM became chief engineer with JOHN F. BENNER as assistant chief engineer.

WILLIAM C. SPEIDEL, JR., Seattle newspaperman and columnist, has joined the publicity staff of Northwest Airlines.

ALBERT H. CHARLTON has been named sales manager of the Aluminum Division of Reynolds Metals Co., with headquarters in Louisville, Ky.



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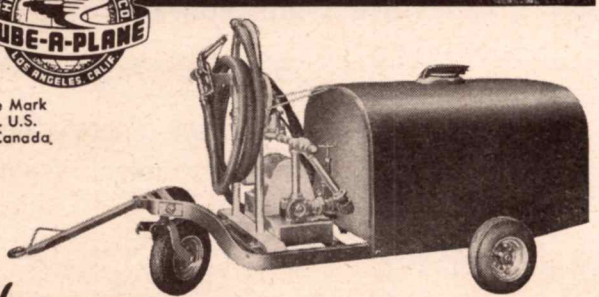
First Showing NEW TANK MODEL

HARMAN EQUIPMENT CO. LUBE-A-PLANE LOS ANGELES, CALIF.

Trade Mark Reg. U.S. and Canada



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Three wheel model now available with 50 to 300 gallon tank made of heavy gauge steel; 12 inch expansion dome and 6 inch hinged fill cap with triplex vent and spring loaded to provide adequate relief area in case of fire. • Single attendant operates . . . fast servicing. Steel-fitted internal gear type pump with pressures to 150 P. S. I. Hydraulically engineered to assure maximum flow at all temperatures down to pour point of oil—without heating.

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DEMOUNTABLE

Interchangeable; Complete gas engine, electric or hand pump units fit standard trailer.

Specify LUBE-A-PLANE
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937 Santa Fe Ave., Los Angeles 21, Calif.

HAVE YOU INQUIRED HOW

THERMONICS

CAN IMPROVE, SIMPLIFY

YOUR PRODUCT, YOUR PLANT, YOUR POST-WAR PLANNING

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Thermonics as a science in itself earns and deserves the attention of:

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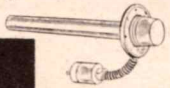
THERMOSWITCH is the prime factor in Thermonics. THERMOSWITCH in its many types and adaptations, offers a lightweight, compact vibration-proof, highly sensitive yet rugged regulatory and detectory unit of almost unlimited utility.



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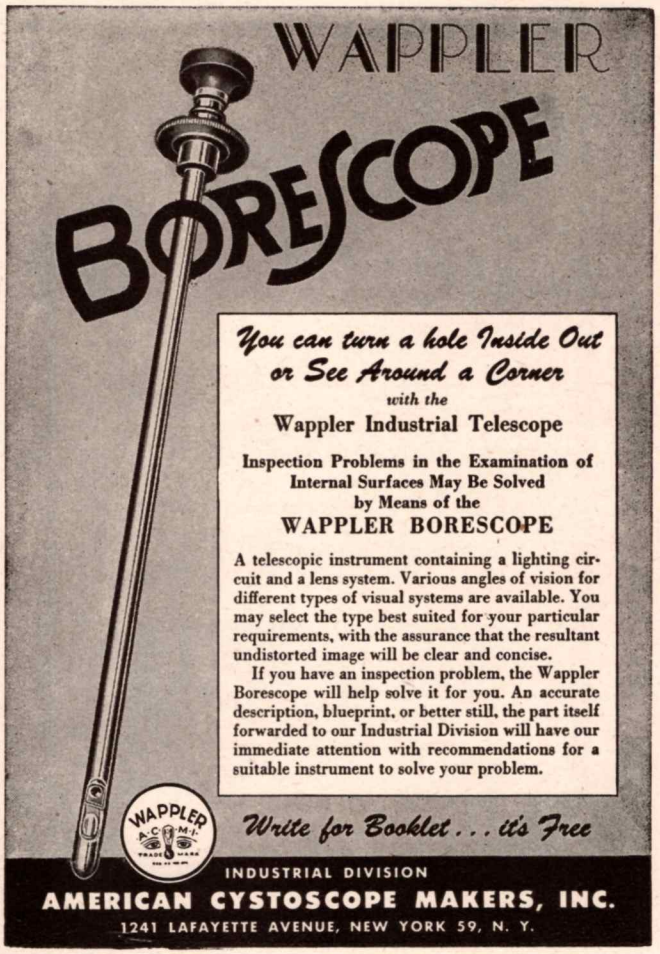
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BORESCOPE
You can turn a hole Inside Out or See Around a Corner
with the
Wappler Industrial Telescope
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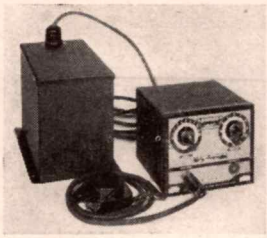

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Classified ADS

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WITH THIS ADVERTISERS' INDEX

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—to obtain additional information on any of the services or products advertised in this issue. The special reply card is for your convenience; please be sure to indicate the advertisements you are interested in by using the REFERENCE numbers which appear BEFORE each name.

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"I've collected good dividends in gasoline mileage all through the war from the Studebaker Champion I bought late in 1940," says a State of Washington insurance man.

"My Champion is a 1942 model and fairly new. In 36,500 miles it has averaged 25 miles per gallon with virtually no repair cost," says a former U. S. government civilian employee in Ohio, now in the Navy.

"Our gas coupons took us farther in our 1939 Champion than many of our friends could go," says a Michigan woman. "All we had ever heard about Studebaker economy has certainly proved true."

"I deliver the mail in Kansas," says another Studebaker owner, "and my Studebaker Champion has been giving me the most economical service of any car I've used on my route in 25 years."

"My Champion's engine has never been touched," says an Idaho clergyman who has already driven his car more than 72,000 miles over all kinds of roads in all kinds of weather.

They're saying it everywhere...

"I'm lucky I've got a Studebaker Champion"

LIKE millions of other Americans, you're undoubtedly thrilled to see new cars again rolling off the production lines.

But if you own a Studebaker Champion, you probably don't have to be too concerned about getting a new Champion right away.

More likely than not, you can choose to avoid the early rush, because there's plenty of fine low-cost transportation still left in the Champion you're driving.

Your good fortune in having a dependable Champion to stand by you won't stop you, of course, from dropping in at your Studebaker dealer's and getting an eyeful of the stunning new air-curve beauty that makes the new Champion such an exciting car. There's nothing like its original and exclusive skyway styling, its distinctive color finishes and luxurious appointments in the lowest price field.

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Studebaker

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To this end, the JORDANOFF CORPORATION maintains an organization of scientists, engineers, technical writers and artist-illustrators. We think this staff is unique in its ability to solve your peacetime presentation problem. This organization will evolve a pictorial analysis to meet your requirements in a wide variety of fields, including operation manuals, personnel training books, product merchandising and technical advertising layouts.

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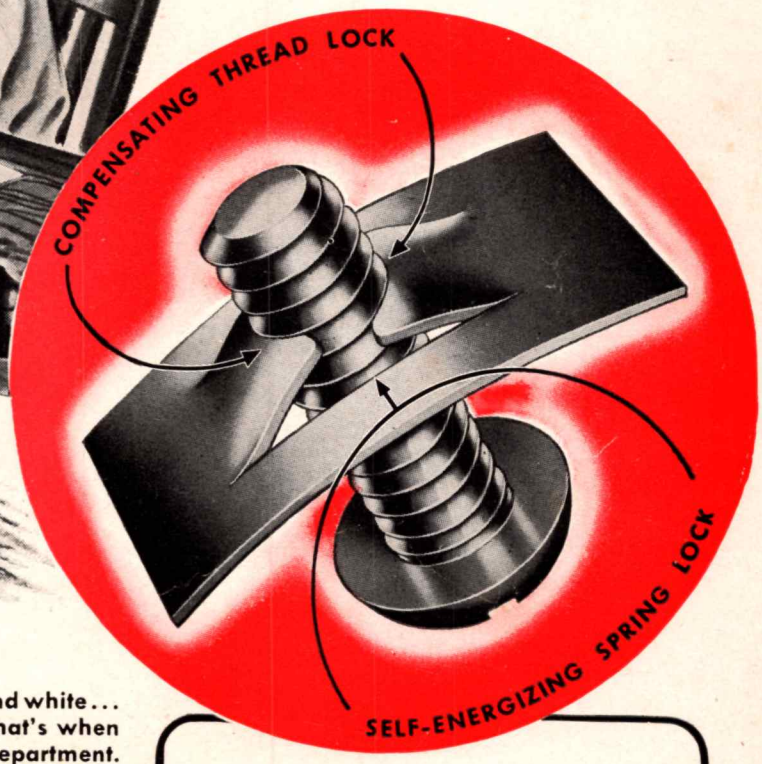

When ALL assembly costs are down in black and white... when TOTAL net assembly costs are figured... that's when SPEED NUTS really show results in the Cost Department.

For SPEED NUTS reduce assembly costs in many ways. They completely eliminate lock washers—saving the cost of the washers *and* the time necessary to handle and install them. Moreover, hundreds of SPEED NUTS have been designed to perform multiple functions and eliminate two or more assembly parts.

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Only SPEED NUTS provide a COMPENSATING thread lock and a SELF-ENERGIZING spring lock. As the screw is tightened the two arched prongs move inward to lock against the root of the screw thread. These free-acting prongs COMPENSATE for tolerance variations. Compression of the arch in prongs and base creates a SELF-ENERGIZING spring lock. These two forces combine to definitely prevent vibration loosening.

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